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Veath, Sr.

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[54] VEHICLE FOR APPLYING AND SPREADING SURFACE COATING MATERIAL TO ROADWAY SURFACES

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[52] U.S. Cl. 404/108; 404/101; 404/112

[58] Field of Search 404/101, 108, 110-112; 239/155, 156, 159-160, 162, 172, 101; 180/24.07, 212

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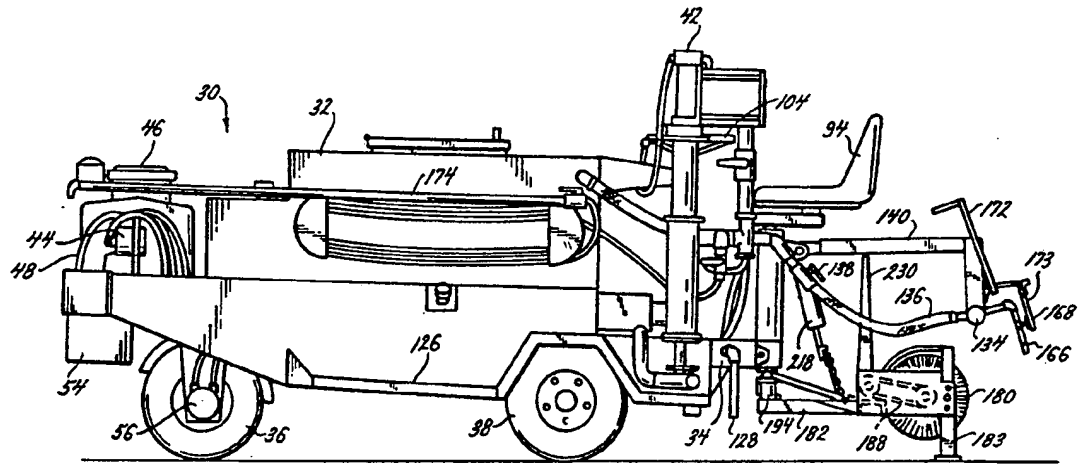
Attorney, Agent, or Firm—Rogers, Howell & Haferkamp

[57] ABSTRACT

A surface coating material applying and spreading apparatus comprises a forward and two rear drive wheels, with each of the three drive wheels being driven by a separate hydraulic motor independent of each other. A hydraulic circuit connects the three hydraulic motors of the drive wheels with a hydraulic pump, and communication between the pump and each of the motors is automatically controllable to drive one, two, or all three of the hydraulic motors and their associated drive wheels. The vehicle also comprises a spray bar assembly that is pivotally connected to a frame of the vehicle, and is pivoted to a raised and lowered position relative to the vehicle frame. The vehicle frame also releasably supports interchangeable rotating brush and wiper blade assemblies. The rotating brush assembly is universally pivotable horizontally and vertically from side to side, about the pivot connection to the vehicle frame. An engagement bar provided on the frame of the brush assembly enables simultaneous raising and lowering of both the brush assembly and the sprayer bar assembly. A separate lock on the frame of the sprayer bar assembly enables it to be locked in its raised position. The wiper blade assembly is also pivotally supported from the vehicle frame to be raised and lowered relative to the frame. The blade assembly comprises two pairs of wiper blades that are pivotally supported on a frame of the assembly. A mechanical linkage connecting the two pairs of blades enables each pair of blades to be pivoted relative to each other from side to side.

16 Claims, 10 Drawing Sheets



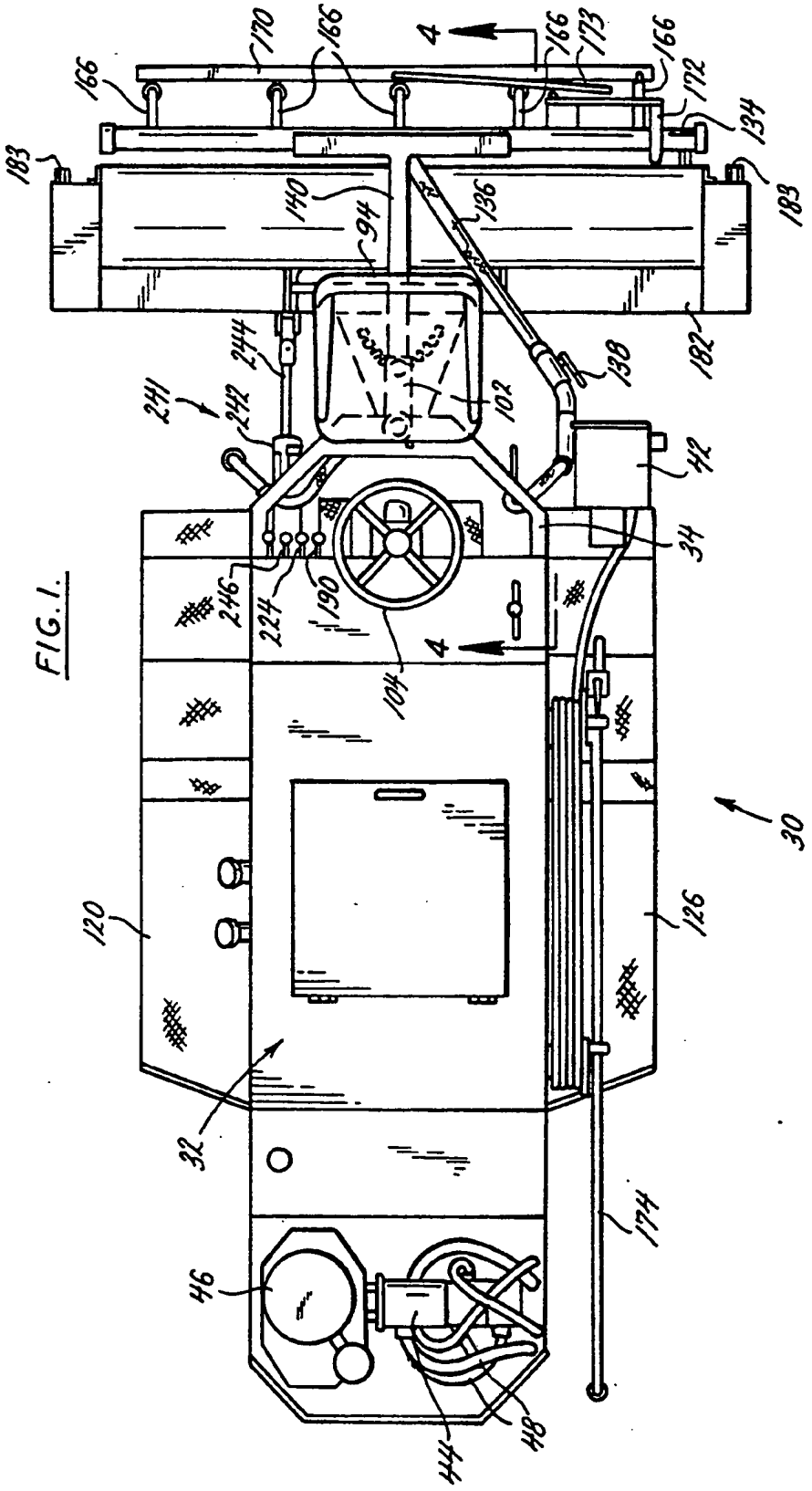

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FIG. 1.

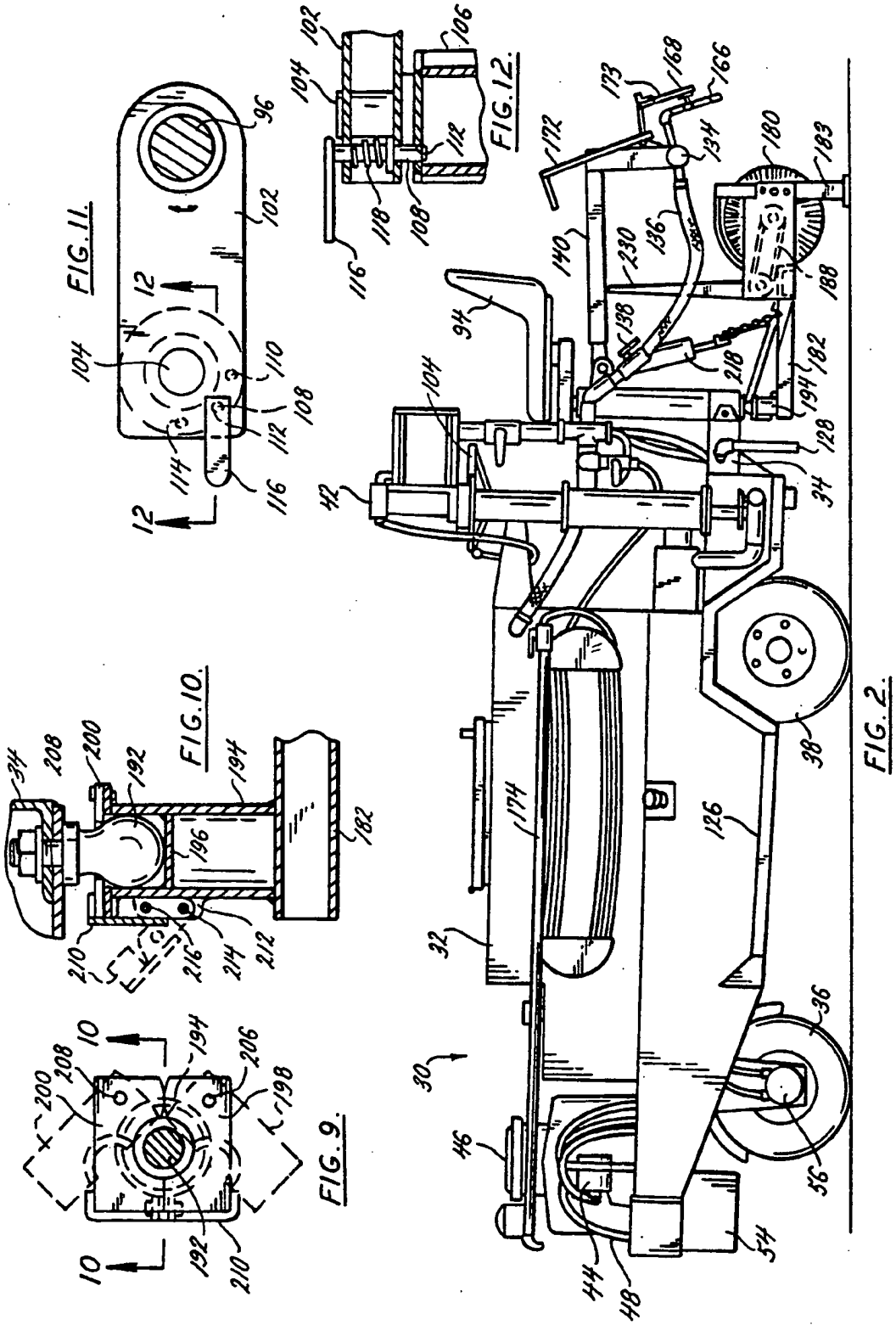

FIG. 2.

FIG. 9.

FIG. 10.

FIG. 11.

FIG. 12.

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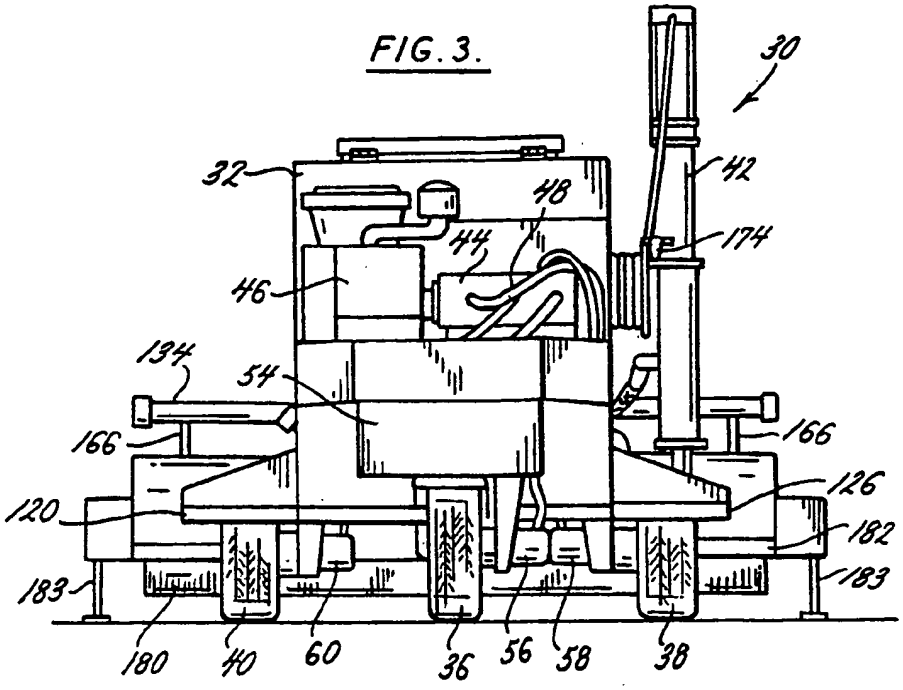
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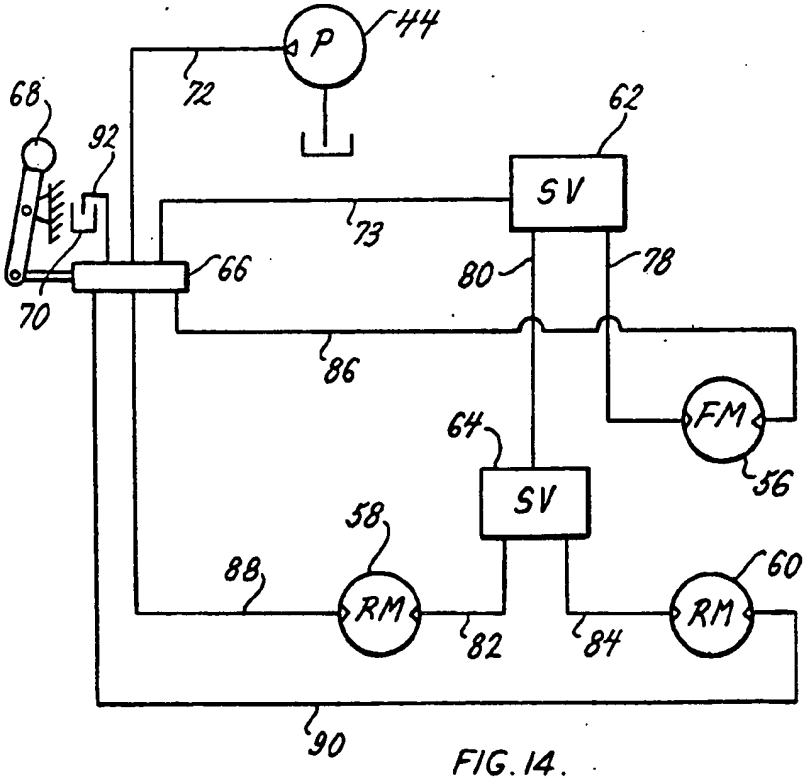
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FIG. 14.

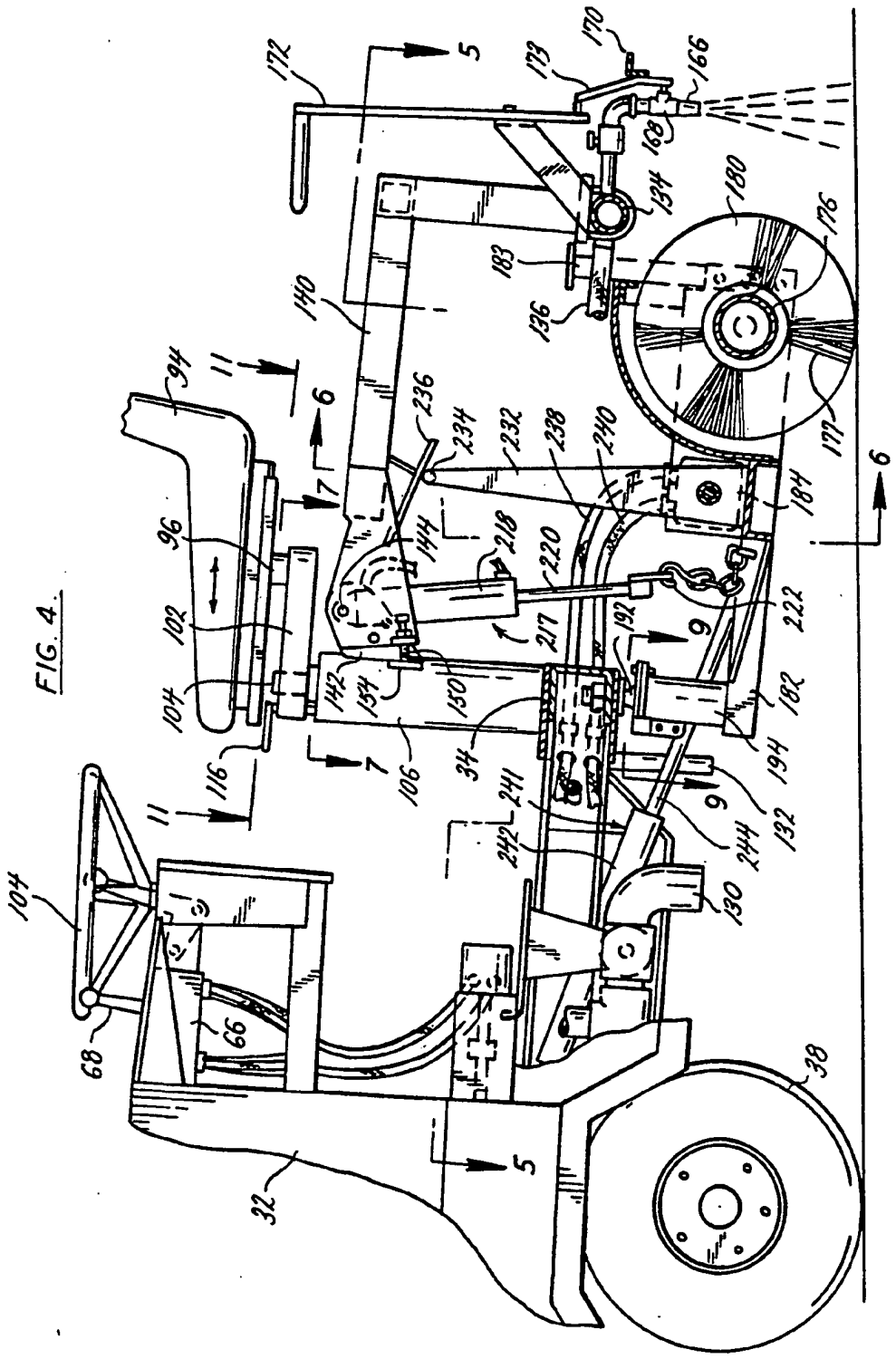
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FIG. 4.

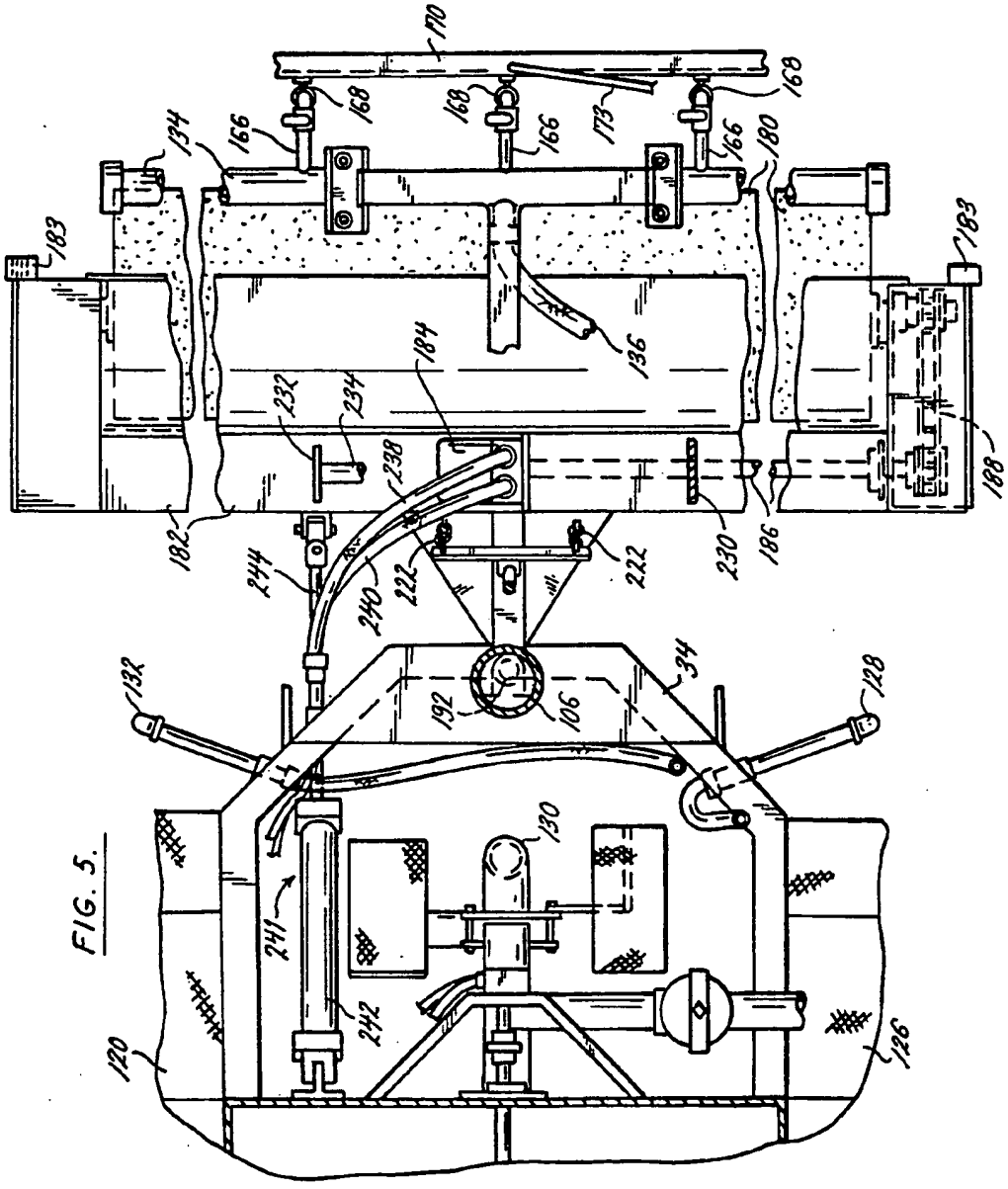
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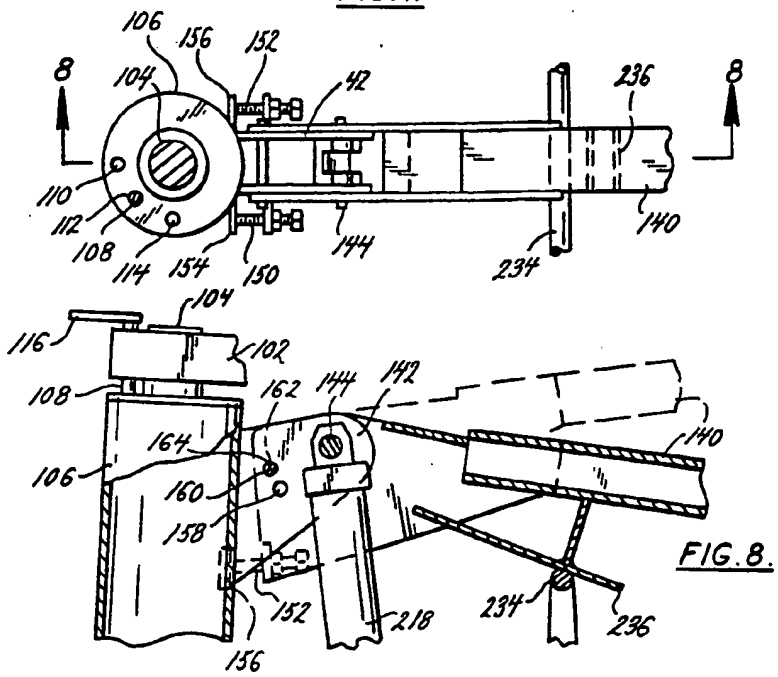
FIG. 5.

FIG. 7.



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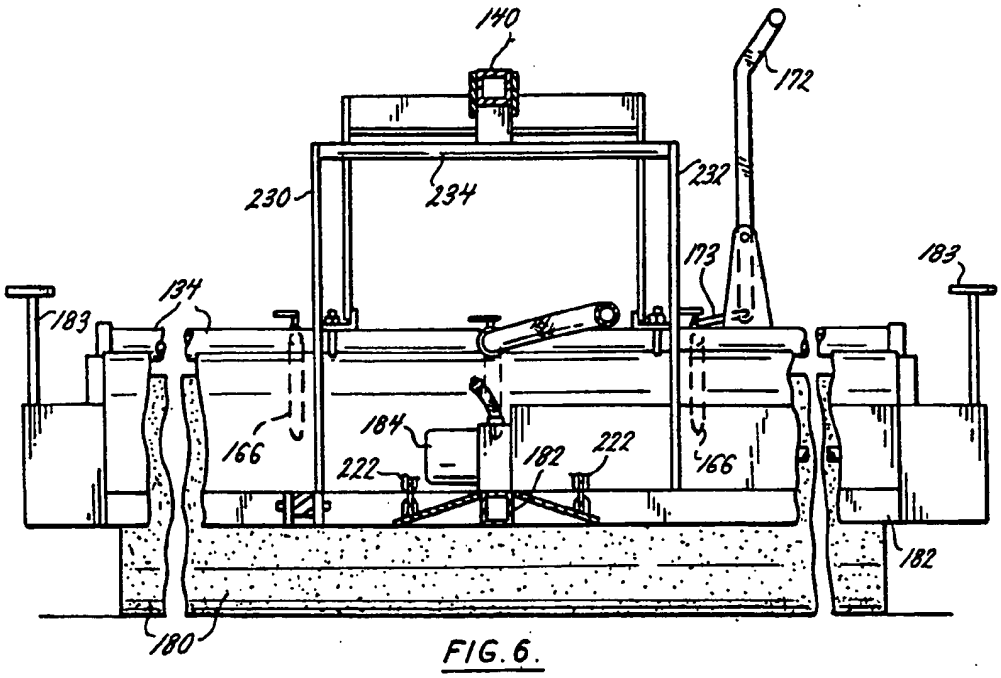

FIG. 6.

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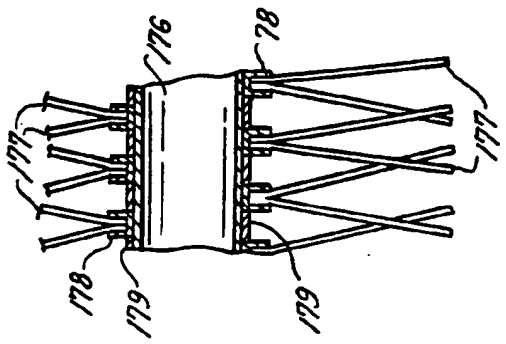


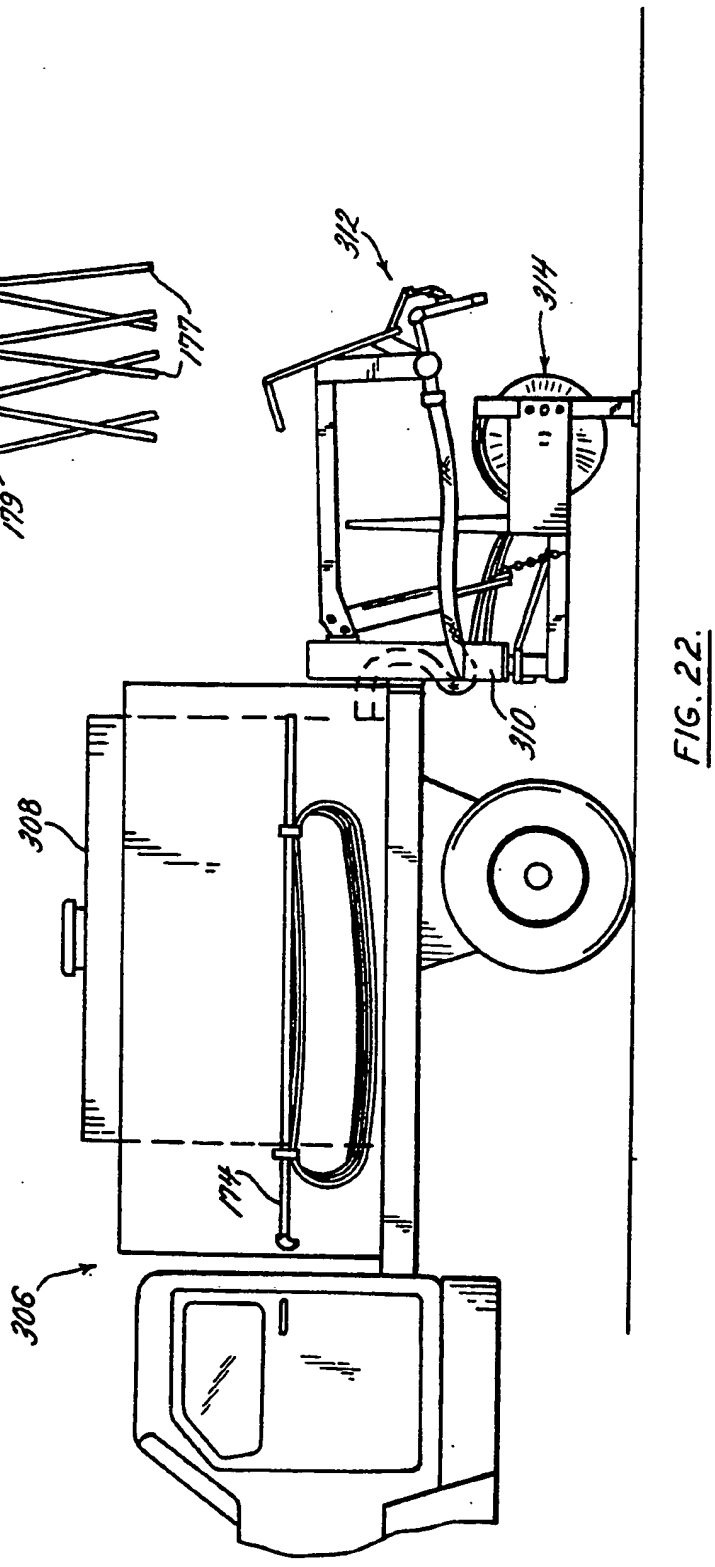


FIG. 22.

FIG. 15.

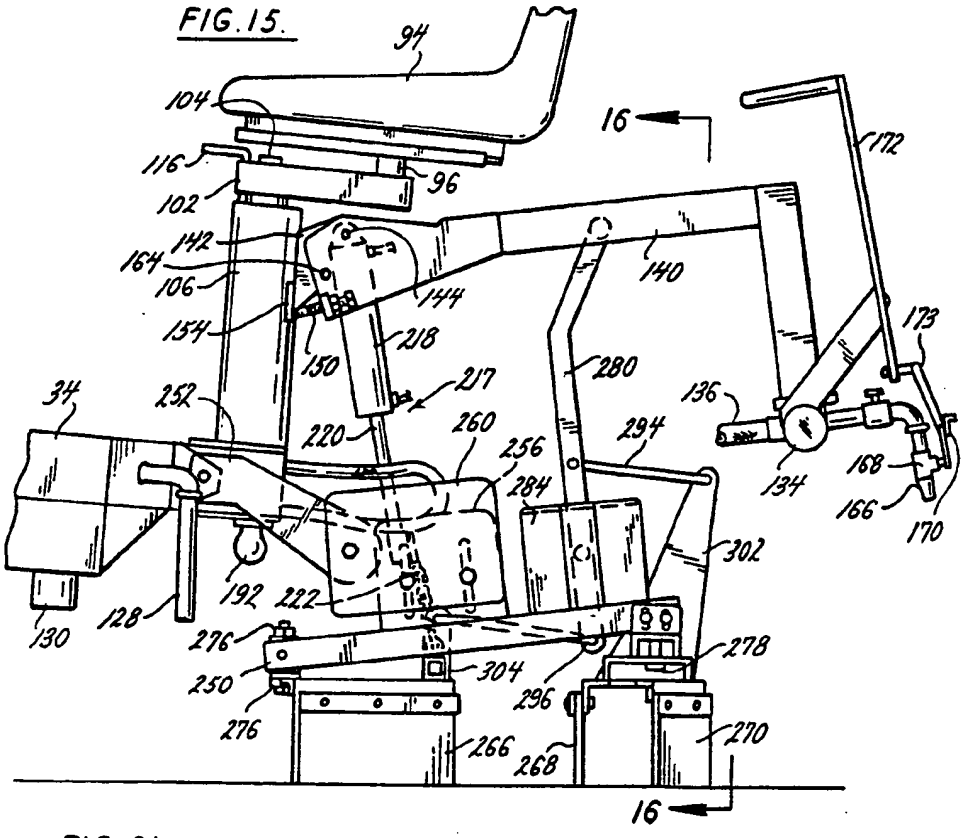
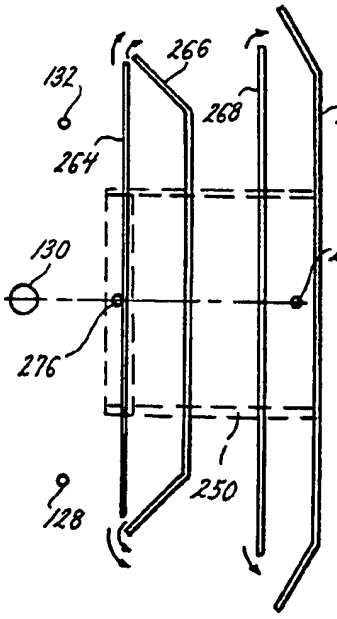


FIG. 21A.



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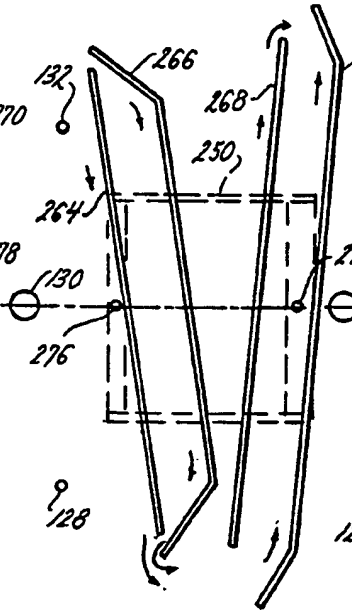

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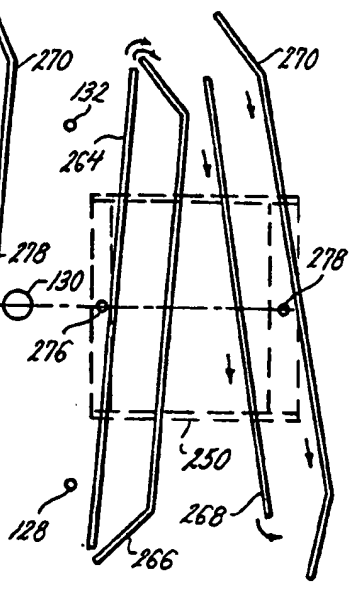

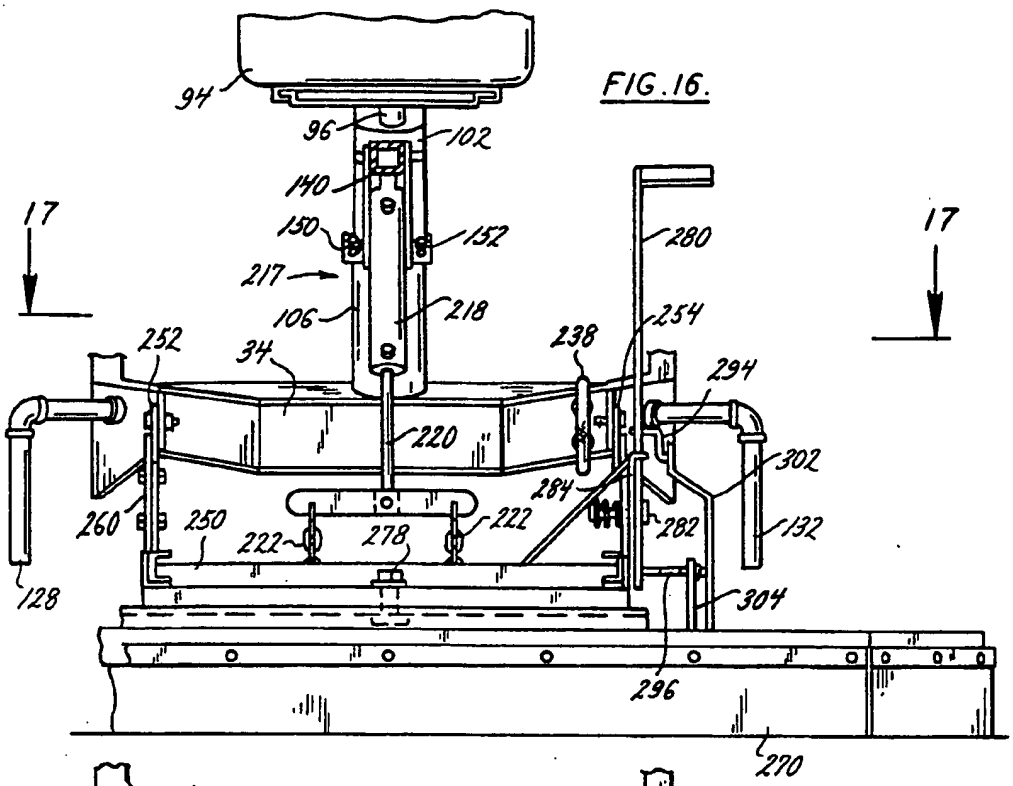

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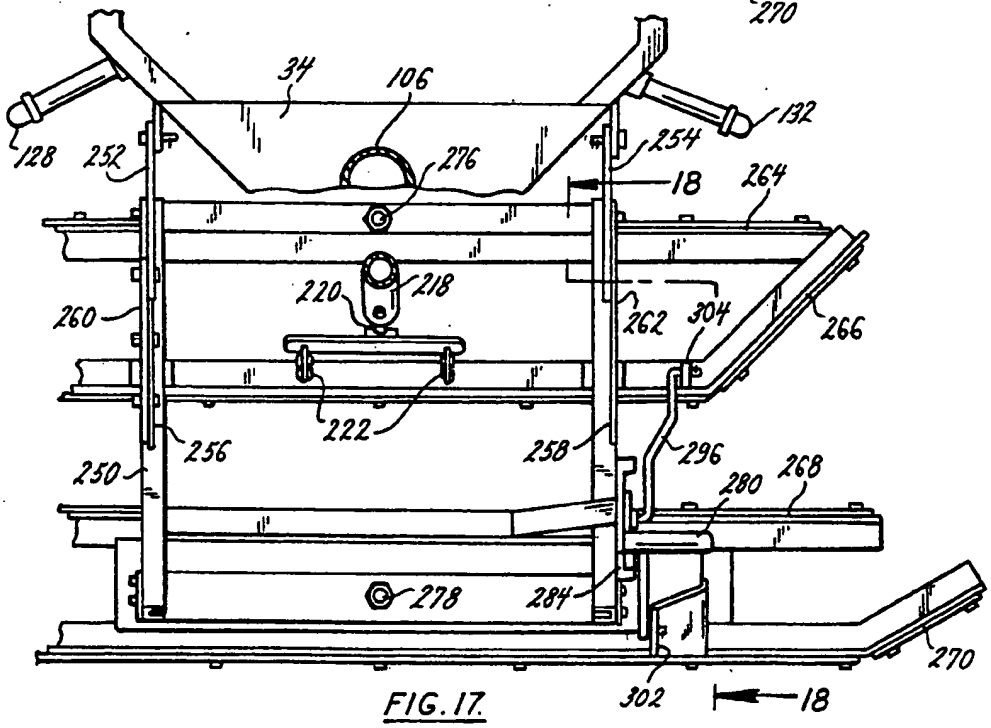

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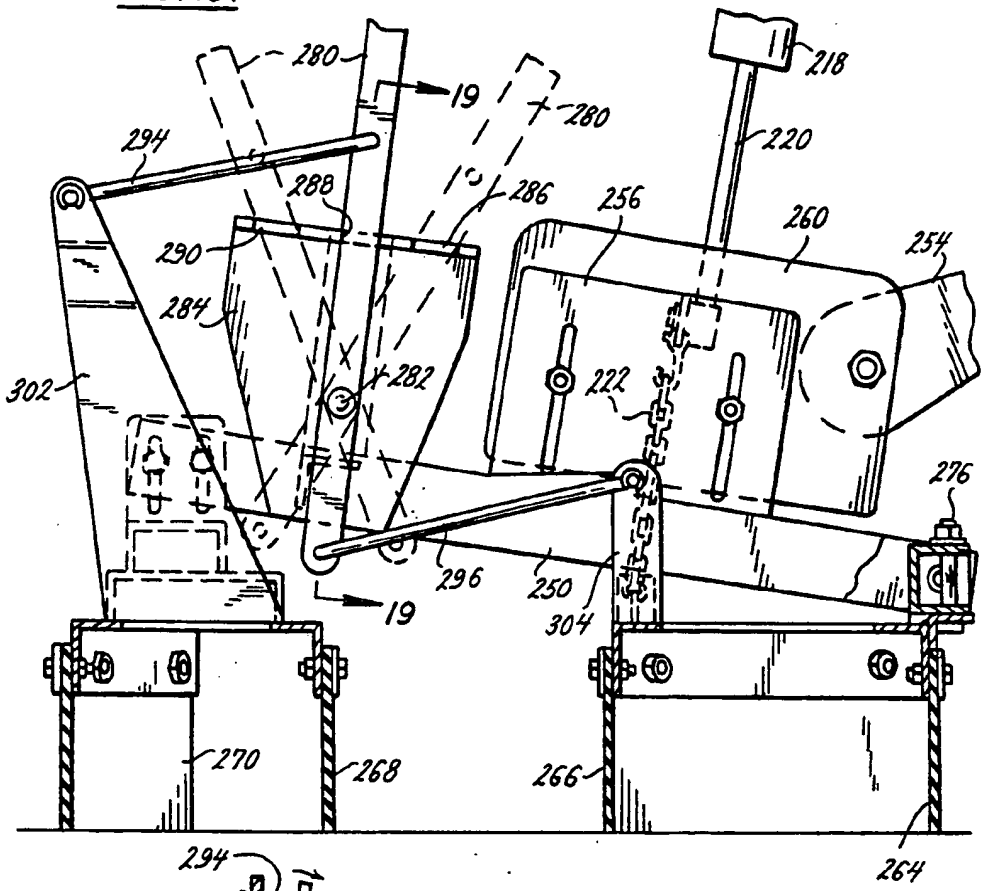

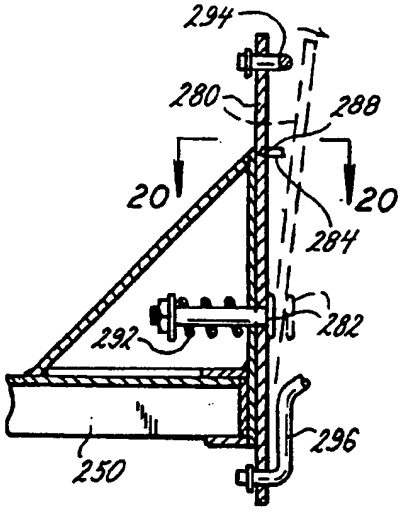

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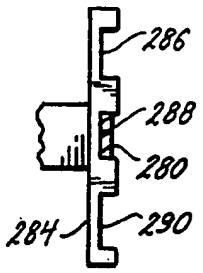

FIG. 20.

VEHICLE FOR APPLYING AND SPREADING SURFACE COATING MATERIAL TO ROADWAY SURFACES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a vehicle for applying and spreading surface coating material on roadway surfaces. In particular, the present invention pertains to a vehicle having a front and two rear drive wheels, where each of the wheels may be driven by the prime mover of the vehicle and power delivered to a slipping wheel will be automatically directed to wheels with traction. The vehicle also employs interchangeable rotating brush and pivoting wiper blade assemblies for spreading surface coating material, and a sprayer bar assembly for dispensing surface coating material to a roadway surface. The rotating brush and pivoting wiper assemblies are arranged to be selectively raised and lowered relative to the vehicle. The sprayer bar assembly is arranged to be selectively raised relative to the vehicle when the rotating brush is raised, and locked in its raised position with the rotating brush assembly being free to be raised and lowered.

2. Description of the Related Art

Roadway surfaces and traffic surfaces in general are exposed to the elements and the wear and tear of vehicle traffic, and in time deteriorate and need repair. Various types of machines have been developed which apply and spread surface coating material to traffic surfaces. Surface coating material has been applied to traffic surfaces in the past by vehicles or machines that dispense the materials by either spraying, brushing, and/or smoothing with a squeegee. While these prior art machines have been effective in applying the material to repair traffic surfaces, many prior art machines are disadvantaged in that they are designed to be used primarily on flat, horizontal surfaces.

Prior art machines often employ only a single drive wheel at the front of the vehicle. This single wheel makes it difficult to use the machine on an inclined surface as the single drive wheel located at the front of the vehicle will loose some of its tractive force and will often slip as it pulls the vehicle up the incline. With the front wheel being the only driven wheel in many prior art machines, this problem makes it very difficult to operate these machines on anything other than a horizontal road surface.

Prior art surface coating machines have also experienced problems in the methods employed in spreading surface coating materials over uneven road surfaces. For example, in surface coating machines employing squeegees or wipers, spreading the coating material before the wiper will tend to cause the material to accumulate to a deeper thickness in low spots in the uneven surface of the road. On road surfaces that have been purposely laid with a lateral incline to allow rain to run off to the side of the road, prior art machines operating on such roads often apply and spread a thicker accumulation of coating material at the outside or lower most edge of the laterally inclined road surface than at the inside or uppermost surface. Although spraying, brushing, and smoothing squeegee assemblies have been developed to provide a variety of means of applying surface coating material to inclined and uneven road surfaces, prior machines are often limited to use with only one or two of these application means, that being the sprayer with a brush or the sprayer with a squeegee. Where a brush or a squeegee may be effective in spreading surface coating material on certain road surfaces, they alone are not effective in spreading material efficiently over all road surfaces that would likely be encountered during the useful life of the machine.

It is an object of the present invention to overcome the disadvantages found in prior art surface coating machines by providing a vehicle for applying and spreading surface coating material on traffic surfaces having three drive wheels that are automatically operated, and that is adapted to apply and spread surface coating material to traffic surfaces by spraying, brushing and/or smoothing with a wiper assembly.

It is a further object of the present invention to provide a three wheeled vehicle for applying and spreading surface coating material, where each of the three wheels is automatically driven by a separate hydraulic motor associated with that wheel, wherein driving power is supplied to all three wheels simultaneously, or driving power is automatically diverted from a slipping wheel and is directed to wheels with traction to maintain constant the driving power delivered to the wheels with traction.

It is a further object of the present invention to provide a vehicle for applying and spreading surface coating material on traffic surfaces that employs a driven front wheel, and having an auxiliary water tank positioned over and forward of the wheel to enhance the traction of that wheel when driving up inclined surfaces.

It is a further object of the present invention to provide a vehicle for applying and spreading surface coating material on traffic surfaces that employs a spray bar assembly for depositing surface coating materials on the surfaces, and also employs interchangeable rotating brush and pivoting wiper assemblies.

It is a further object of the present invention to provide a vehicle for applying and spreading surface coating material on traffic surfaces that alternately employs a rotating brush and pivoting wiper assembly that are both arranged to be selectively pivoted laterally from side to side about a vertical axis, and vertically up and down about a horizontal axis.

It is a further object of the present invention to provide a vehicle for applying and spreading surface coating material on traffic surfaces that employs a sprayer bar assembly and a rotating brush assembly that are arranged to be raised relative to the vehicle, and the sprayer bar assembly is capable of being locked in place to enable lowering and raising the brush assembly independent of the sprayer bar assembly.

SUMMARY OF THE INVENTION

The surface coating material applying and spreading vehicle of the present invention is generally comprised of a vehicle frame that supports a reservoir holding surface coating material and a water tank located at the front of the vehicle, the frame in turn being supported on three wheels. One of the three wheels is centered at the forward end of the vehicle frame, and the other two of the three wheels are provided on opposite sides of the rearward end of the vehicle frame. The vehicle frame also supports a prime mover, a hydraulic fluid pump driven by the prime mover, and an operator's seat that is pivotally mounted on the frame to enable the operator to swing laterally from side to side on the vehicle to

view the path of vehicle travel along the side of the vehicle.

Each of the three wheels of the vehicle is a drive wheel, with each of the wheels being automatically driven by a separate hydraulic motor associated with each wheel. Each of the three motors is in turn connected by a hydraulic circuit to the hydraulic pump driven by the prime mover. A series of valves are employed in the hydraulic circuit of the vehicle to automatically control the level of power delivered to each of the three hydraulic motors by the hydraulic pump. A first valve of the hydraulic circuit serves as a means of proportionally supplying hydraulic fluid under pressure from the pump, equally to both of the two hydraulic motors driving the two rear wheels of the vehicle. A second valve of the hydraulic circuit serves as a means of controlling the proportion of hydraulic fluid pressure supplied by the pump to the hydraulic motor that drives the front wheel of the vehicle, and to the two hydraulic motors that drive the rear wheels of the vehicle. A third manually operated valve is also provided in the hydraulic circuit. The manual valve serves as a means of selectively controlling the forward and reverse direction of travel of the vehicle as well as the vehicle speed. By the hydraulic circuit described above, the power supplied by the pump is equally distributed to all three drive wheels of the vehicle and is automatically controlled to power all three wheels, and is automatically diverted from a slipping wheel or wheels and is supplied to the wheel or wheels with traction to maintain constant the driving power delivered to the wheels with traction.

To enhance the tractive force of the front drive wheel of the vehicle, an auxiliary water tank is supported on the vehicle frame above the front drive wheel and slightly ahead of the wheel. The weight of the water contained in the auxiliary tank enhances the tractive force of the front drive wheel, even when the vehicle of the invention is being driven up an inclined surface.

A fogger suspended below the vehicle frame is also supplied with water from the auxiliary tank. The fogger is positioned before surface coating material dispensers of the vehicle, and spreads water over a traffic surface to be paved to enhance the spreading of the material on the surface. The vehicle is also provided with a hand operated wand that is supplied with water under pressure from the auxiliary tank. The wand is employed in cleaning the vehicle by spraying pressurized water.

The vehicle employs two different means of applying surface coating materials to traffic surfaces. A series of three surface coating material dispensers are supported by the vehicle frame and are spatially arranged laterally across the rearward end of the vehicle. Two of the three dispensers communicate with a surface coating material pump that, in turn, communicates with the reservoir of surface coating material. A manually operable valve controls the communication of the pump with the two dispensers. The third dispenser is located at the center rear of the vehicle and is gravity fed from the material reservoir. The three dispensers dispense the surface coating material onto the traffic surface in front of the material spreading assemblies of the invention.

A sprayer bar assembly is also pivotally supported on the vehicle frame and is suspended by the frame in a position behind the material spreading assemblies of the invention. The sprayer bar may be selectively raised and locked in its raised position to position it away from the working area of the material spreading assemblies. The sprayer bar may also be lowered to its operative position just behind the spreading assemblies. The sprayer bar is provided with a series of five nozzles spatially arranged along the bar, which is positioned laterally relative to the vehicle. A manually operated linkage assembly interconnects each of the five nozzles and simultaneously controls the dispensing of surface coating material from each of the nozzles. As with the two dispensers in front of the spreading assemblies, the sprayer bar is supplied with surface coating material from the reservoir by the surface coating material pump. A manual valve controls the supply of surface coating material to the sprayer bar.

The surface coating material applying and spreading vehicle of the present invention also comprises two interchangeable means of spreading the surface coating material applied to a traffic surface.

A rotating brush assembly is arranged to be pivotally supported on the frame of the vehicle at the rearward end of the vehicle. A hydraulically operated piston and cylinder motor is connected between the vehicle frame and the rotating brush assembly. The hydraulic motor in turn is connected with the hydraulic pump of the vehicle, and the motor selectively raises or lowers the rotating brush assembly relative to the vehicle in response to actuation of a manual valve that controls the communication of the motor with the hydraulic pump. The rotating brush assembly supports a rotating cylindrical brush laterally across the rearward end of the vehicle. The rotating brush is selectively operated to rotate in first and second directions, and at varying speeds by a hydraulic motor powering the brush. The hydraulic motor of the brush assembly also communicates with the hydraulic pump of the vehicle, and the direction of rotation of the brush as well as the speed of rotation are controlled by a manual valve interconnected between the brush hydraulic motor and the hydraulic pump. An additional hydraulic motor is connected between the rotating brush assembly and the vehicle frame. This additional motor is also a piston and cylinder assembly that communicates with the hydraulic pump of the vehicle. A manually operated valve is interconnected between this piston and cylinder motor and the hydraulic pump. Selective actuation of the manual valve causes the hydraulic motor to pivot the rotating brush assembly from side to side about a vertical axis extending through the pivot connection of the brush assembly and the vehicle frame. The rotating brush assembly also supports a horizontal engagement bar above the rotating brush. The horizontal bar is positioned to engage with the sprayer bar assembly, and cause the sprayer bar to raise in response to the rotating brush assembly being raised. From the raised position, the sprayer bar can also be lowered by lowering the rotating brush assembly, or can be locked in its raised position so that the rotating brush assembly may be lowered independent of the sprayer bar assembly. The rotating brush assembly, when attached to the vehicle frame, is positioned between the three surface coating material dispensers and the five spray nozzles of the sprayer bar assembly.

A wiper blade assembly is provided to be used interchangeably with the rotating brush assembly. The wiper blade assembly is pivotally connected to the vehicle frame at the rearward end of the vehicle, and the hydraulic motor that is connected between the rotating brush assembly and the vehicle frame is also connected between the wiper blade assembly and the vehicle

frame. The hydraulic motor, as with the rotating brush assembly, is selectively operated by a manual valve that controls fluid communication between the hydraulic motor and the hydraulic pump of the vehicle. Selective operation of the manual valve causes the hydraulic motor to raise and lower the wiper blade assembly relative to the vehicle frame. The wiper assembly itself is comprised of two pairs of dual wipers that are pivotally mounted on a frame of the assembly. The pivoting connection of the dual wiper blades to the assembly frame enables each pair of wiper blades to pivot from side to side about a vertical axis. A manually operated linkage interconnects the two pairs of dual blades. By manipulating the manual linkage, the operator of the vehicle may pivot the left side of the dual wipers toward each other while pivoting the right side of the wipers away from each other, or may pivot the right side of the wipers toward each other while pivoting the left side of the wipers away from each other, or may pivot the pairs of dual wipers to extend parallel to each other laterally across the back of the vehicle. The rearward most wiper of each pair of dual wipers of the wiper blade assembly are also specially configured to catch surface coating material that is spread out over the ends of the front most wiper blade of each pair, and redirect the surface coating material back toward the middle of the rearward most wiper of each pair. The wiper blade assembly is interchanged with the rotating brush assembly of the invention to provide the most efficient means of spreading surface coating material for the particular traffic surface to be covered with surface coating material by the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and features of the present invention are revealed in the following detailed description of the preferred embodiment of the invention and in the drawing Figures wherein:

FIG. 1 is a plan view of the surface coating material applying and spreading vehicle of the present invention;

FIG. 2 is a side elevation view of the vehicle of the present invention;

FIG. 3 is a front elevation view of the vehicle of the present invention;

FIG. 4 is a segmented side elevation view, partially in section, of the vehicle supporting the rotating brush assembly of the invention;

FIG. 5 is a segmented plan view taken along the line 5—5 of FIG. 4;

FIG. 6 is a segmented elevation view, partially in section, of the rotating brush assembly of the invention taken along the line 6—6 of FIG. 4;

FIG. 7 is a segmented plan view, partially in section, of the pivoting seat mount and pivot connection of the rotating brush assembly to the vehicle frame taken along the line 7—7 of FIG. 4;

FIG. 8 is a segmented elevation view, partially in section, of the pivot connection between the rotating brush assembly and the vehicle frame taken along the line 8—8 of FIG. 7;

FIG. 9 is a plan view in section of the pivoting connection supporting the rotating brush assembly from the vehicle frame taken along the line 9—9 of FIG. 4;

FIG. 10 is a segmented elevation view, partially in section, of the pivot connection between the rotating brush assembly and the vehicle frame taken along the line 10—10 of FIG. 9;

FIG. 11 is a plan view in section of the pivoting seat support taken along the line 11—11 of FIG. 4;

FIG. 12 is a segmented view, partially in section, of the locking pin assembly of the pivoting seat taken along the line 12—12 of FIG. 11;

FIG. 13 is a segmented elevation view in section of the structure of the brush of the rotating brush assembly;

FIG. 14 is a schematic diagram of the hydraulic circuit that supplies the driving power to the three wheels of the vehicle;

FIG. 15 is a segmented side elevation view of the pivoting connection between the wiper blade assembly and the vehicle frame;

FIG. 16 is a segmented elevation view of the wiper blade assembly taken along the line 16—16 of FIG. 15;

FIG. 17 is a segmented plan view of the wiper blade assembly taken along the line 17—17 of FIG. 16;

FIG. 18 is a segmented side elevation view of the wiper blade assembly taken along the line 18—18 of FIG. 17;

FIG. 19 is a segmented view of the manual adjustment linkage of the wiper blade assembly taken along the line 19—19 of FIG. 18;

FIG. 20 is a plan view of the three position detent rack used in adjusting the orientation of the wiper blade assembly, taken along the line 20—20 of FIG. 19;

FIG. 21 is a schematic representation of three possible adjustment configurations of the pairs of dual wiper blades of the wiper blade assembly; and

FIG. 22 is a segmented side elevation view showing the rotating brush assembly of the invention supported from the rearward end of a utility vehicle, that in turn supports the surface coating material reservoir on its bed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The surface coating material applying and spreading vehicle 30 of the present invention is shown in FIGS. 1 and 2. The vehicle of the present invention comprises a reservoir 32 that houses both the supply of surface coating material carried by the vehicle, and a supply of water. The reservoir is connected with a vehicle frame 34, that in turn is supported on three wheels 36, 38, 40. The surface coating material stored in the reservoir is supplied to the material dispensing assemblies of the vehicle by a pump 42. A hydraulic pump 44 is provided at the forward end of the vehicle. The hydraulic pump is driven by a prime mover 46, either a diesel or gas engine, and supplies hydraulic fluid under pressure to the hydraulic circuit of the vehicle. The hydraulic fluid pressure is employed to drive the vehicle and to operate the surface coating material applying and spreading assemblies of the vehicle in a manner to be explained. The high pressure hydraulic fluid delivered by the hydraulic pump is routed to the various motors operated by the pressurized fluid through a series of high pressure hoses 48 that make up a part of the hydraulic circuit of the vehicle of the invention.

The vehicle is also provided with an auxiliary water tank 54 supported on the vehicle frame at a forward end of the vehicle. Positioning the auxiliary water tank 54 forward of the front drive wheel 36 applies a large portion of the weight of the water contained by the tank to the front drive wheel and, thereby, increases the tractive force of this drive wheel. The auxiliary tank is connected with a manual sprayer (not shown) that may

be used to clean the vehicle after a surface coating operation. The auxiliary water tank is also drainable into the main water tank contained in the vehicle reservoir 32.

Each of the three wheels supporting the vehicle are drive wheels. Each of the three wheels has a hydraulic motor associated with the wheel, and each of the wheels is driven by operation of its associated hydraulic motor. The front wheel 36 of the vehicle is driven by a first hydraulic motor 56, and the left and right rear wheels 38, 40 of the vehicle are driven by second and third hydraulic motors 58, 60. A schematic diagram of the hydraulic fluid circuit that supplies pressurized hydraulic fluid to the three hydraulic motors and drives the motors and their associated drive wheels is shown in FIG. 14. This circuit includes the hydraulic pump 44, a first proportioning or splitter valve 62, a second proportioning or splitter valve 64, a third manually operated valve 66, and the front and two rear hydraulic motors 56, 58, 60. The manual valve 66 is controlled by manipulation of a manual lever 68 mounted to the vehicle and mechanically linked with the valve.

In operation in the forward drive direction, the hydraulic fluid pump 44 draws hydraulic fluid from a reservoir of fluid 70 contained in the reservoir 32 of the vehicle, and supplies this fluid under pressure to the supply conduit 72. The pressurized hydraulic fluid flows through the supply conduit 72 to the manual valve 66. The manual valve, having been manipulated to the forward drive position, directs the fluid through the first conduit 73 to the first proportioning valve 62. The first proportioning valve is set up to split the hydraulic fluid supplied to it, and supply the fluid to the second and third conduits 78, 80, with one-third of the total pressurized hydraulic fluid supplied to the first valve 62 being delivered to the first hydraulic motor 56, and two-thirds of the total pressurized hydraulic fluid supplied to the valve being delivered to the second proportioning valve 64 through the third conduit 80. The second proportioning valve 64 splits the pressurized hydraulic fluid supplied to it through the third conduit 80, and delivers this fluid to the fourth and fifth conduits 82, 84 in equal proportions. The pressurized hydraulic fluid travels through the fourth and fifth conduits 82, 84 and is delivered to the second and third hydraulic motors respectively. By employing the first and second proportioning valves 62, 64 in the hydraulic circuit described above, it can be seen that one-third of the total pressurized hydraulic fluid supplied to the circuit from the hydraulic pump 44 is routed to each of the first, second, and third hydraulic motors 56, 58, 60. A sixth fluid conduit 86 exits the first hydraulic motor 56 and routes hydraulic fluid to the manual operated valve 66. Seventh and eighth hydraulic conduits 88, 90 exit the second and third hydraulic motors 58, 60 respectively, and route hydraulic fluid to the manual valve 66. The manual valve 66, in turn, communicates with the fluid reservoir 70 through a ninth hydraulic conduit 92 to complete the hydraulic circuit. In order for the high pressure hydraulic fluid supplied by the hydraulic pump 44 to each of the respective first, second and third hydraulic motors 56, 58, 60 to drive the motors in a forward direction, the hydraulic fluid supplied to the motors must pass through the motors and return to the reservoir by way of the sixth, seventh, and eighth hydraulic fluid conduits 86, 88, 90, the manual valve 66, and the ninth hydraulic fluid conduit 92. The alternate communication between the sixth, seventh, and eighth hydraulic fluid conduits 86, 88, 90, and the supply conduit 72 or ninth fluid conduit 92 is controlled by the manual valve 66. When the manual valve 66 is manipulated to the forward drive position, it establishes fluid communication between the supply conduit 72 and the first fluid conduit 73, and it establishes fluid communication between the sixth, seventh, and eighth hydraulic fluid conduits 86, 88, 90 and the ninth fluid conduit 92. In this position of the manual valve, pressurized hydraulic fluid flows through the first, second and third hydraulic motors 56, 58, 60 and drives the motors. This in turn drives the front 36 and rear wheels 38, 40 of the vehicle.

In prior art hydraulic motor drives, should a wheel slip, the hydraulic motor turns faster due to the decrease tractive force on the wheel. The faster turning hydraulic motor driving the slipping wheel provides less resistance to fluid flow through the motor. This in turn causes an increased amount of pressurized fluid to be supplied to the motor of the slipping wheel than to other wheels with traction.

In the present invention, the two proportioning valves 62, 64 control the supply of pressurized fluid to the three motors so that should one or two of the three wheels driven by the motors slip, the proportioning valves maintain control of the proportion of pressurized fluid supplied to the three motors. The proportioning valves will still maintain control of the total pressurized fluid circulating through the circuit so that one third of the pressurized fluid is supplied to the first hydraulic motor 56 and one third of the total pressurized hydraulic fluid is supplied to each of the second and third hydraulic motors 58, 60. Providing the proportioning valves 62, 64 in the fluid circuit ensures that if one or two wheels of the vehicle slip, there will still be driving power supplied to one or two of the wheels with traction. Further movement of the manual valve lever 68 in the forward position increases the fluid flow through the valve 66 and in turn increases the speed of the motors 56, 58, 60 driving the vehicle wheels.

The manual valve 66 is also manipulated to reverse the flow of hydraulic fluid through the circuit and the valves and motors to reverse the direction of vehicle travel. In the reverse drive position of the manual valve 66, pressurized hydraulic fluid is supplied from the pump 44 through the supply conduit 72, the manual valve 66, the sixth fluid conduit 86, the first hydraulic motor 56, the second fluid conduit 78, the first proportioning valve 62, the first fluid conduit 73, the manual valve 66, and the ninth fluid conduit 92 to the fluid reservoir 70. This fluid circuit drives the first hydraulic motor 56 in a reversed direction. Fluid from the supply conduit 72 is also directed by the manual valve 66 to the seventh and eighth fluid conduits 88, 90, the second and third hydraulic motors 58, 60, the fourth and fifth fluid conduits 82, 84, the second proportioning valve 64, the third fluid conduit 80, the first proportioning valve 62, the first fluid conduit 72, the manual valve 66, and the ninth fluid conduit 92 to the fluid reservoir 70. This fluid circuit drives the second and third hydraulic motors 58, 60 in the reverse direction. The first and second proportioning valves 62, 64 work in the reverse direction in the same manner in which they do in the forward direction, proportioning one third of the total fluid pressure supplied through the circuit to each of the three hydraulic motors 56, 58, 60 and maintaining the fluid pressure supplied to the motors constant even if one or two of the vehicle wheels should slip. Just as in the forward drive direction, further movement of the

manual valve lever 68 in the reversed position increases the fluid flow through the valve 66 and increases the speed of the motors 56, 58, 60 driving the vehicle in the reverse direction.

While operating the vehicle, the operator's seat pedestal enables the operator to move laterally from side to side to gain an unobstructed view of the surface coating path along the side of the vehicle. The construction of the operator's seat is best seen in FIGS. 4, 7, and 11. The operator's seat 94 is rotatably mounted on a pedestal 96 that in turn is mounted on the distal end of a cantilever arm 102. The operator seat 94 is also capable of being adjusted forward and backward on the pedestal 96 to adjust the position of the operator relative to the vehicle steering wheel 104. The opposite end of the cantilever arm 102 is pivotally supported on a pivot post 104 that is in turn secured to the top end of a vertical column 106 projecting upward from the vehicle frame 34. The cantilever arm 102 pivots about the pivot post 104. Provided in the cantilever arm 102 adjacent its connection to the pivot post 104 is a spring biased locking pin 108. A series of three holes 110, 112, 114 are provided in a top surface of the vertical column 106 and are dimensioned to receive the locking pin 108. In use, the operator pulls upward on a pin handle 116 against the bias of the locking pin spring 118 to disengage the locking pin 108 from the hole 112 in which it is engaged. With the pin 108 disengaged from the hole 112, the cantilever arm 102 is free to pivot about the pivot post 104 to swing the operator's seat 94 laterally out to the left or right sides of the vehicle. The locking pin handle 116 may then be released by the operator to cause the spring biased locking pin 108 to engage in one of the two outside holes 110, 114 to lock the operator seat in its adjusted position to the right side or the left side of the vehicle respectively. From the adjusted position of the seat to the right or left side of the vehicle, the operator may sight down the vehicle running boards 120, 126 respectively, to assist the operator in driving the vehicle in a straight path over the surface being coated. The running boards 120, 126 also provide a step for top loading the material tank of the vehicle. The seat 94 is also adjustable in forward and backward directions, enabling the operator to adjust his sitting position relative to the controls for the three drive wheels of the vehicle, the surface coating material dispensing controls, and the controls which operate the surface coating material applying and spreading assemblies of the vehicle.

The dispensing assemblies of the vehicle include three surface coating material dispensers 128, 130, 132 spatially arranged laterally across the vehicle. The three material dispensers are supported by the vehicle frame, and unlike prior art dispensers that are fed by gravity, two of the three dispensers are selectively supplied with surface coating material from the surface coating material pump 42. Selective operation of manual valves provided in the material supply conduit communicating the material pump 42 with the two dispensers 128, 132 supplies the surface coating material to the dispensers. Supplying surface coating material to the three dispensers 128, 130, 132 dispenses surface coating material on the traffic surface in front of the material spreading assemblies of the vehicle to be described later.

The material dispensing assemblies of the vehicle also include a sprayer bar assembly. The sprayer bar assembly includes a laterally disposed sprayer bar 134 that is supplied with surface coating material through a material conduit 136 connected between the sprayer bar and the material pump 42. The material conduit 136 is also provided with a manual valve 138 positioned intermediate the sprayer bar 134 and the material pump 42. The manual valve 138 controls the supply of surface coating material to the sprayer bar.

The sprayer bar 134 is pivotally supported on the vehicle frame by a sprayer bar frame 140. The sprayer bar frame 140 is pivotally connected to a bracket 142 secured to the vertical column 106 of the operator seat assembly by a pivot pin 144. The position in which the sprayer bar 134 is suspended over the traffic surface by the sprayer bar frame 140 is adjusted by a pair of threaded bolts 150, 152. The bolts are screw threaded through a portion of the sprayer bar frame adjacent the pivot pin 144, and abut against a pair of stop plates 154, 156 secured to the vertical column 106 of the operator seat assembly. By adjusting the extent to which the adjustment screws 150, 152 extend from the sprayer bar frame 140, the position of the sprayer bar 134 suspended above the traffic surface is adjusted. The sprayer bar frame support bracket 142 is also provided with a pair of holes 158, 160 adjacent the pivot pin 144. The pair of holes 158, 160 are positioned to line up with a hole 162 provided through the sprayer bar frame 140. The sprayer bar frame 140 is arranged so that one of the two pairs of holes 158, 160 in the sprayer bar bracket 142 will line up with the hole 162 in the sprayer bar frame 140 when the sprayer bar is in its raised and lowered positions respectively. With the position of the sprayer bar adjusted, a pin 164 is inserted through the aligned holes to lock the sprayer bar in its selected position suspended from the vehicle frame. With the two pairs of holes provided in the sprayer bar bracket, the sprayer bar may be locked by insertion of the pin 164 through the aligned holes of the frame and bracket in either a lowered or raised position relative to the vehicle frame.

The sprayer bar itself 134 extends laterally across the rearward end of the vehicle, and communicates with a series of five material dispensing nozzles 166 that are spatially arranged across the sprayer bar. Each of the nozzles is opened to dispense surface coating material through the nozzle by a valve assembly 168. Each of the valve assemblies 168 is connected to a control bar 170 that extends parallel to the sprayer bar 134. The control bar, in turn, is pivotally connected to a pivoting control arm 172 by a linkage member 173. By pivoting movement of the control bar 172, the operator of the vehicle is capable of simultaneously opening or closing each of the valve assemblies 168 of the sprayer bar dispenser nozzles 166. Operation of the sprayer bar assembly dispenses surface coating material behind the spreader assemblies of the vehicle.

A manually carried sprayer wand 174 is also supplied with surface coating material by the material pump 42. The wand 174 may be selectively operated to dispense surface coating material in areas that are difficult to reach using the vehicle 30.

The first described of the surface coating material spreading assemblies of the vehicle is a rotating brush assembly. The rotating brush assembly includes a rotating brush 180 having a general cylindrical shape, and extending laterally across the rearward end of the vehicle. The detail of the brush is best seen in FIG. 13. The brush is constructed on a center shaft 176, and includes a plurality of bristles 177 secured in a length of U-shaped channel 178 that is spiraled over the shaft 176. A spacing strap 179 is also spiraled over the shaft surface

and spacially disposes the spirals of the channel **178** over the shaft surface. The brush **180** is rotatably supported on a brush assembly frame **182**, and is powered by a hydraulic motor **184**. The frame includes a pair of pivoting supports **183** that are lowered to support the frame when transporting or storing the vehicle to prevent the brush from being crushed by the weight of the frame. The brush **180** is driven by the hydraulic motor **184** through a drive shaft **186**, and a chain drive **188** connecting the brush **180** to the hydraulic motor **184**. The hydraulic motor **184** is powered by pressurized hydraulic fluid supplied from the hydraulic pump **44**. Selective actuation of a manual valve **190** on the dashboard of the vehicle controls the brush in a neutral condition, and a forward and reverse drive rotation, and also controls the forward and reverse rotational speeds.

The brush assembly frame **182** is suspended from a rearward end of the vehicle frame **34** by a ball and socket connection. The vehicle frame **34** has attached at its rearward end a ball **192** that extends downward from the vehicle frame. At the forward end of the brush assembly frame **182** there is provided a short tube **194** that extends upward from the frame. The interior dimensions of the tube **194** are just large enough to receive the ball **192** within the tube. A bottom plate **196** is provided inside the tube to limit the extent to which the ball **192** can extend into the tube interior. A pair of pivoting closing plates **198, 200** are pivotally connected at a top end of the tube **194** by pivot pins **206, 208**. The closing plates **198, 200** have a semi-circular notch cut into their opposed edges. The notches are dimensioned to engage around the shank of the ball **192** when the ball is inserted into the tube **194** and the closing plates **198, 200** are closed around the shank. The position of the closing plates **198, 200** closed around the ball shank is shown in FIG. **9**, along with the respective positions of the closing plates **198, 200** (shown in phantom lines) in their opened positions to allow insertion or removal of the ball **192** into or out of the tube **194** interior. A plate clamp **210** is pivotally mounted on a flange **212** on the side of the tube **194** by a pivot pin **214**. With the closing plates **198, 200** closed around the shank of the ball **192** to hold the ball inside the interior of the tube **194**, the plate clamp **210** is pivoted upward as viewed in FIG. **10**, and engages around the opposite edges of the closing plates as best seen in FIG. **9**. With the plate clamp **210** in this position, a pin **216** is inserted through a hole provided in the flange **212** and a hole in the plate clamp **210**. The pivot pin holds the plate clamp securely in its position around the closing plates **198, 200**, thereby establishing a releasable universal pivoting connection between the vehicle frame and the brush assembly frame that enables the brush assembly frame to pivot laterally from side to side relative to the vehicle frame, and to pivot horizontally up and down relative to the vehicle frame. This universally pivoting movement of the brush assembly frame **182** relative to the vehicle frame enables the rotating brush **180** to follow virtually any contour of the traffic surface being coated by the vehicle.

A hydraulic reciprocating motor **217** is also pivotally connected between the vehicle frame and the brush assembly frame. The hydraulic reciprocating motor is comprised of a cylinder **218** pivotally connected to the sprayer bar frame supporting bracket **142** at the pin **144**, and a reciprocating piston rod **220** connected by adjustable length chain **222** to the brush assembly frame **182**. Opposite sides of a piston (not shown) connected to the piston rod **220** and contained within the cylinder **218** are selectively communicated with pressurized hydraulic fluid or drained, to selectively raise and lower the brush assembly frame **182** relative to the vehicle frame **34**. Communication between the cylinder **218** of the reciprocating hydraulic motor and the hydraulic fluid pump **44** is controlled by a manually operated lever **224** provided on the dashboard of the vehicle. Selective manipulation of the manual lever **224** supplies pressurized hydraulic fluid to the cylinder **218** of the reciprocating motor to extend the piston rod **220** from the motor and permit the brush assembly frame **182** to be lowered. This enables the rotating brush **180** to engage the traffic surface being coated. On alternate operation of the manual lever **224**, pressurized hydraulic fluid is supplied to the opposite end of the cylinder **218** of the hydraulic motor, causing the piston rod **220** to be retracted into the cylinder. This causes the hydraulic motor to raise the brush assembly frame **182** from the traffic surface, thereby disengaging the rotating brush **180** from the surface.

The brush assembly frame **182** includes a pair of vertical supports **230, 232** that extend upward from the frame to a horizontal engagement bar **234**. The horizontal engagement bar **234** is positioned to engage against an abutment bracket **236** secured at the bottom of the sprayer bar frame **140**. The engagement between the abutment bracket **236** and the engagement bar **234** enables the brush assembly frame **182** to pivot the sprayer bar frame **140** upward about the pivot pin **144** when the brush assembly frame **182** is raised relative to the vehicle frame. The engagement between the brush assembly frame and the sprayer bar frame also permits the sprayer bar frame to be lowered when the brush assembly frame is lowered relative to the vehicle. Alternately, when the sprayer bar frame is raised relative to the vehicle frame by raising the brush assembly frame relative to the vehicle frame, the operator may then insert the locking pin **164** through the aligned holes in the support bracket **142** and the sprayer bar frame **140** to lock the sprayer bar frame in its raised position relative to the vehicle. With the sprayer bar frame so locked in its raised position, the operator may then selectively raise and lower the brush assembly frame **182** relative to the vehicle independent of the sprayer bar frame. In this manner, the operator of the vehicle may raise and lower both the sprayer bar frame and the brush assembly frame simultaneously relative to the vehicle frame, or may raise the sprayer bar frame and brush assembly frame relative to the vehicle frame, and lock the sprayer bar frame in its raised position to permit the selective lowering and raising of the brush assembly frame independent of the sprayer bar frame.

The brush assembly frame **182** is also completely removable from its supporting pivoting connection to the vehicle frame by disengaging the closing plates **198, 200** from their engagement around the ball shank **192**, and disconnecting the hydraulic fluid pressure hoses **238, 240** that communicate the hydraulic motor **184** of the rotating brush **180** with the hydraulic circuit of the vehicle. Releasable connections are provided between the hoses **238, 240** and the hydraulic motor **184** to facilitate the quick disassembly of the rotating brush assembly from the vehicle frame. The connection between the reciprocating hydraulic motor and the brush assembly frame **182** is quickly disassembled by detaching a pair of hooks at the ends of the chain **222** connecting the brush assembly frame to the hydraulic motor.

A second reciprocating hydraulic motor 241 is also connected between the brush assembly and the vehicle frame. This second motor 241 provides the pivoting movement laterally from side to side of the brush assembly frame relative to the vehicle frame. This second hydraulic motor is also comprised of a cylinder 242 pivotally connected to the vehicle frame, and a reciprocating piston rod 244 connected to a piston slidably received in the cylinder at one end, and pivotally connected to the brush assembly frame 182 at its opposite end. This second hydraulic motor is also connected to the hydraulic pump 44 of the vehicle, and is selectively retracted and extended by manipulation of a manual lever 246 provided on the dashboard of the vehicle. By viewing FIG. 1, it can be seen that extending the piston rod 244 from the piston cylinder 242 will cause the brush assembly frame 182 to pivot about the ball 192 of the ball and socket connection to the left. Manipulating the manual lever 246 to control the piston rod 244 to be retracted into the piston cylinder 242 will cause the brush assembly frame 182 to pivot about the ball 192 of the ball and socket connection to the right as viewed in the drawing Figure. The connection between the second reciprocating hydraulic motor 241 and the brush assembly frame 182 is quickly disassembled to enable disassembly of the brush assembly from the vehicle frame by detaching the pivot connection of the piston rod 244 to the brush assembly frame 182.

Disassembly of the brush assembly from the frame 34 of the vehicle enables assembly of a wiper blade assembly to the vehicle frame. The wiper blade assembly is comprised of a frame 250 that is suspended from the vehicle frame 34 by a pair of pivot arms 252, 254 that are releasably and pivotally connected to the vehicle frame. The blade assembly frame 250 includes a pair of stationary plates 256, 258 that extend upward from a top surface of the frame. Each plate has a pair of slots that extend vertically through the plates. A pair of adjustment plates 260, 262 are adjustably connected to the stationary plates 256, 258 respectively by a pair of nut and bolt threaded fasteners that extend through holes (not shown) provided in the adjustment plates and the vertical slots in the stationary plates. The threaded fasteners releasably secure the two plates together in a desired adjusted position. The adjustment plates 260, 262 are in turn connected to the pivot arms 252, 254, respectively. By adjusting the connection between the stationary plates 256, 258 and the adjustment plates 260, 262, the orientation of the blade assembly frame 250 relative to the surface being coated may be adjusted.

The blade assembly frame 250 is also suspended from the vehicle frame 34 by the chains 222 of the first reciprocating hydraulic motor 217. This hydraulic motor is the same motor that is employed in raising and lowering the rotating brush assembly relative to the frame. Just as in connecting the rotating brush assembly to the hydraulic motor, one end of the chains 222 is connected to the frame 250 of the blade assembly, and the opposite end of the chains 222 is connected to the distal end of the piston rod 220 of the reciprocating hydraulic motor. Just as in the operation of the rotating brush assembly, alternate extension and retraction of the piston rod 220 into and out of the cylinder 218 of the hydraulic motor causes the blade assembly frame 250 to be raised and lowered about the pivoting connection between the pair of pivot arms 252, 254 and the vehicle frame 34.

Suspended below the blade assembly frame 250 are two pairs of wiper blades 264, 266, 268, 270. The arrangement of the wiper blades of the two pairs, relative to each other, is best seen in FIGS. 21A through 21C. As seen in FIG. 21, the forward most of the pairs of wiper blades 264, 268 are substantially straight and extend laterally across the rearward end of the vehicle. The second or rearward most of the pairs of wiper blades 266, 270 each include forward turned portions at their opposite ends. This configuration of the wiper blades of each pair causes surface coating material that is spread along the road surface by the front wipers 264, 268, and spreads past the opposite ends of the front wipers, to be gathered in by the forward turned opposite ends of the second wipers 266, 270 and spread back toward the center of the second wipers. Each of the forward and rearward pair of wipers is constructed on an angle iron frame that is itself pivotally attached to the blade assembly frame 250. The pair of forward wiper blades 264, 266 are attached to and pivot relative to the frame 250 by the pivot connection 276 provided by a nut and bolt fastener. The rearward pair of wiper blades 268, 270 are pivotally connected to the frame 250 by the pivot connection 278 provided by a nut and bolt fastener between the pair of blades and the blade assembly frame 250. The two pivot connections 276, 278 enable the pairs of wiper blades to pivot from side to side about vertical axis extending through the two pivot connections.

A manually operable linkage assembly is connected between the two pairs of wiper blades to control their pivoting movement. The linkage assembly is best seen in FIG. 18, and is comprised of a manual lever 280 connected by a pivot connection 282 to a support bracket 284, that in turn is secured to the wiper assembly frame 250. A series of detents 286, 288, 290 are provided in an out-turned upper edge of the support bracket 284 to provide positive engagement between the manual lever 280 and the detents in three adjusted positions of the pairs of wiper blades. The pivot connection 282 between the manual lever 280 and the bracket 284 is a spring biased connection as is best seen in FIG. 19. This connection permits the operator of the vehicle to move the manual lever 280 away from the bracket 284 and against the bias of a spring 292 of the pivot connection 282, to pivot the manual lever about the pivot connection and engage the lever in a selected one of the three detent positions 286, 288, 290. The phantom lines in FIG. 19 show the manual lever 280 moved outward away from the bracket 284 against the bias of the pivot connector spring 292. Connected to the manual lever 280 on opposite sides of the pivot connection 282 are upper and lower linkage members 294, 296. The opposite ends of these two linkage members are pivotally connected to vertical arms 302, 304 that are securely connected to and extend vertically upward from the frames of the rearward and forward pairs of wiper blades respectively. As is best seen in FIG. 18, manipulation of the manual lever 280 forward or to the right in the drawing Figure, to engage the manual lever in the detent 286, will cause the two linkage members 294, 296 to pull the right hand ends of the pair of wiper blade assemblies toward each other to the relative positions of the wiper blades shown in FIG. 21C. In this position, the pairs of wiper blades will spread surface coating material to the right across the first wiper blade 264, and surface coating material that is spread around the far right end of the first pair of wiper blades will be gathered in by the second pair of wiper blades and spread to the left by the second pair of blades. Manipulation of the

manual lever 280 rearward or to the left as viewed in FIG. 18 to engage the lever in the detent 290 will cause the linkage members 294, 296 to spread the right hand ends of the pairs of wiper blades away from each other to the relative positions shown in FIG. 21B. In this position of the pairs of wiper blades, the first pair of wiper blades will spread surface coating material to the left, and surface coating material that passes around the left hand side of the first pair of wiper blades will be gathered in by the second pair of wiper blades and spread to the right. By manipulating the manual lever 280 to the position shown in FIG. 18, with the lever engaging in the middle detent 288, the pair of linkage members 294, 296 will position the pairs of wiper blades parallel to each other as shown in FIG. 21A. Between the three relative positions of the pairs of wiper blades obtainable by the wiper blade assembly of the present invention and shown in FIGS. 21A–21C, the wiper blade assembly of the present invention may be employed to spread surface coating material over a wide variety of traffic surfaces having various curvatures and inclinations.

Although the surface coating material applying and spreading apparatus of the present invention has been described as a self-contained vehicle, many of the novel features of the present invention may be incorporated into an existing vehicle without departing from the scope of the invention. FIG. 22 of the drawings shows a flat bed truck 306 supporting a reservoir of surface coating material 308, and also having a frame 310 attached at its rearward end that supports many of the features of the present invention. The frame 310 is shown supporting the sprayer bar assembly 312 and the rotating brush assembly 314 of the preferred embodiment of the invention described above. It should be apparent that the rotating brush assembly 314 of this embodiment may be disassembled from the frame 310 and replaced with the previously described wiper blade assembly.

While the present invention has been described by reference to specific embodiments, it should be understood that modifications, and variations of the invention may be constructed without departing from the scope of the invention defined in the following claims.

I claim:

1. A vehicle for applying and spreading surface coating material on roadway surfaces, the vehicle comprising:

a vehicle frame;

a surface coating material reservoir supported on the vehicle frame;

a sprayer bar assembly supported on the vehicle frame for pivoting movement relative thereto, the sprayer bar assembly having a plurality of spray nozzles spatially arranged across the sprayer bar;

a surface coating material pump supported on the vehicle frame, the pump being operatively connected between the reservoir and the sprayer bar assembly;

a valve operatively connected between the pump and the sprayer bar assembly for selective communication of the pump with the sprayer bar assembly to supply surface coating material from the reservoir to the sprayer bar assembly on selective operation of the valve; and,

a rotating brush assembly is pivotally supported on the vehicle frame and is adapted to be raised and lowered relative to the frame, the brush assembly is arranged to engage the sprayer bar assembly and raise and lower the sprayer bar assembly as the brush assembly is raised and lowered.

2. The vehicle of claim 1, wherein:

the sprayer bar assembly is adapted to be locked in its raised position and remain raised as the brush assembly is raised and lowered.

3. The vehicle of claim 1, wherein:

a wiper blade assembly is adapted to be pivotally supported on the vehicle frame in place of the rotating brush assembly, and the blade assembly is adapted to be raised and lowered relative to the frame.

4. The vehicle of claim 3, wherein:

the wiper blade assembly includes two pairs of wiper blades, and each pair of wiper blades is selectively pivotable about a vertical axis.

5. A vehicle for applying and spreading surface coating material on roadway surfaces, the vehicle comprising:

a vehicle frame;

a rotating brush assembly pivotally supported on the vehicle frame and adapted to be raised and lowered relative to the vehicle frame;

a motor means connected between the brush assembly and the frame, the motor means being selectively actuated to raise and lower the brush assembly relative to the frame;

a sprayer bar assembly pivotally supported on the frame;

the brush assembly and sprayer bar assembly being arranged so that the brush assembly engages the sprayer bar assembly and raises and lowers the sprayer bar assembly as the brush assembly is raised and lowered.

6. The vehicle of claim 5, wherein:

the sprayer bar assembly is adapted to be locked in its raised position and remain raised as the brush assembly is raised and lowered.

7. The vehicle of claim 5, wherein:

a second motor means is connected between the brush assembly and the frame, the second motor means being selectively actuated to pivot the brush assembly from side to side about a vertical axis.

8. The vehicle of claim 5, wherein:

a wiper blade assembly is adapted to be pivotally supported on the vehicle frame in place of the rotating brush assembly, the blade assembly being adapted to be raised and lowered relative to the frame.

9. The vehicle of claim 8, wherein:

the wiper bade assembly includes two pairs of wiper blades, each pair of blades being selectively pivotable about a vertical axis.

10. The vehicle of claim 9, wherein;

the two pairs of wiper blades are selectively pivotable in the same or opposite directions.

11. A vehicle for applying and spreading surface coating material on roadway surfaces, the vehicle comprising:

a vehicle frame;

a rotating brush assembly pivotally supported on the vehicle frame and adapted to be raised and lowered about a horizontal axis, and pivoted from side to side about a vertical axis relative to the vehicle frame;

a first motor means connected between the brush assembly and the frame, the motor means being

selectively actuated to raise and lower the brush assembly relative to the frame; and

a second motor means connected between the brush assembly and the frame, the second motor means being selectively actuated to pivot the brush assembly, from side to side relative to the frame.

12. The vehicle of claim **11**, wherein:

the brush assembly includes a third motor means connected to the rotating brush, the third motor means being selectively actuated to rotate the brush in either a first or a second direction.

13. A vehicle for applying and spreading surface coating material on roadway surfaces, the vehicle comprising:

a vehicle frame;

a surface coating material reservoir supported on the vehicle frame;

a sprayer bar assembly supported on the vehicle frame for pivoting movement relative thereto, the sprayer bar assembly having a plurality of spray nozzles spatially arranged across the sprayer bar;

a surface coating material pump supported on the vehicle frame, the pump being operatively connected between the reservoir and the sprayer bar assembly;

a valve operatively connected between the pump and the sprayer bar assembly for selective communication of the pump with the sprayer bar assembly to supply surface coating material from the reservoir to the sprayer bar assembly on selective operation of the valve; and,

a wiper blade assembly pivotally supported on the vehicle frame and adapted to be raised and lowered relative to the frame, the wiper blade assembly being arranged to engage the sprayer bar assembly and raise and lower the sprayer bar assembly as the wiper blade assembly is raised and lowered.

14. The vehicle of claim **13**, wherein:

the sprayer bar assembly is adapted to be locked in its raised position and remain raised as the wiper blade assembly is raised and lowered.

15. The vehicle of claim **13**, wherein:

a rotating brush assembly is adapted to be pivotally supported on the vehicle frame in place of the wiper blade assembly, and the brush assembly is adapted to be raised and lowered relative to the frame.

16. The vehicle of claim **13**, wherein:

the wiper blade assembly includes two pairs of wiper blades, and each pair of wiper blades is selectively pivotable about a vertical axis.

* * * * *

United States Patent [19]

Bower

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[45] **July 31, 1973**

[54] **EMERGENCY FIRE EXTINGUISHER**

[75] Inventor: **James C. Bower**, North Olmstead, Ohio

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3,400,863	9/1968	Brown	222/176 X

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[57] **ABSTRACT**

The extinguisher comprises a sealed spherical tank precharged with dry fire extinguishing powder and gaseous media under pressure sufficient to expel the power through a syphon tube. The tube has an inlet near the tank bottom and an outlet connected to a control valve on the top of the tank. A relatively short discharge hose having a dispensing nozzle at its discharge end controlled by a manual valve is connected to the valve.

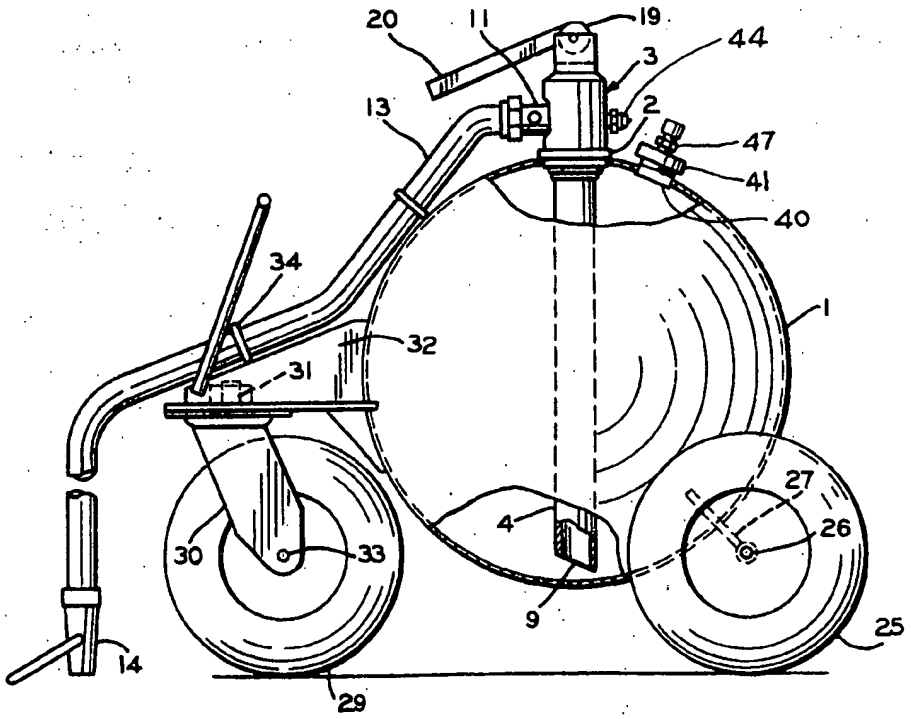
Three wheels support the tank. They are arranged in a triangular pattern, the front wheel being a caster having an upright swivel axis disposed forwardly of the tank. The extinguisher is small enough to be hand propelled and steered by one man by pulling on the hose.

The discharge hose is secured to the caster wheel bracket close to the swivel axis of the caster wheel and close to the level of the center of gravity of the extinguisher so that, as the extinguisher is pulled and steered by the hose, caster wheel foremost, the line of pull is constrained to pass substantially through the swivel axis and below the center of gravity of the extinguisher.

The tank has a check valve for admitting precharging gaseous media into the tank through the syphon tube, and near its top has a filling opening for powder sealed by a detachable cap. The cap has an additional check valve operable for admitting and releasing pressurized gaseous media, selectively, from a level above the powder while the tank remains upright.

All of the wheels are of a selected diameter large enough to prevent upsetting of the extinguisher as it is pulled and steered by the hose, even over rough terrane.

15 Claims, 4 Drawing Figures



2 Sheets-Sheet 1

Fig. 1.

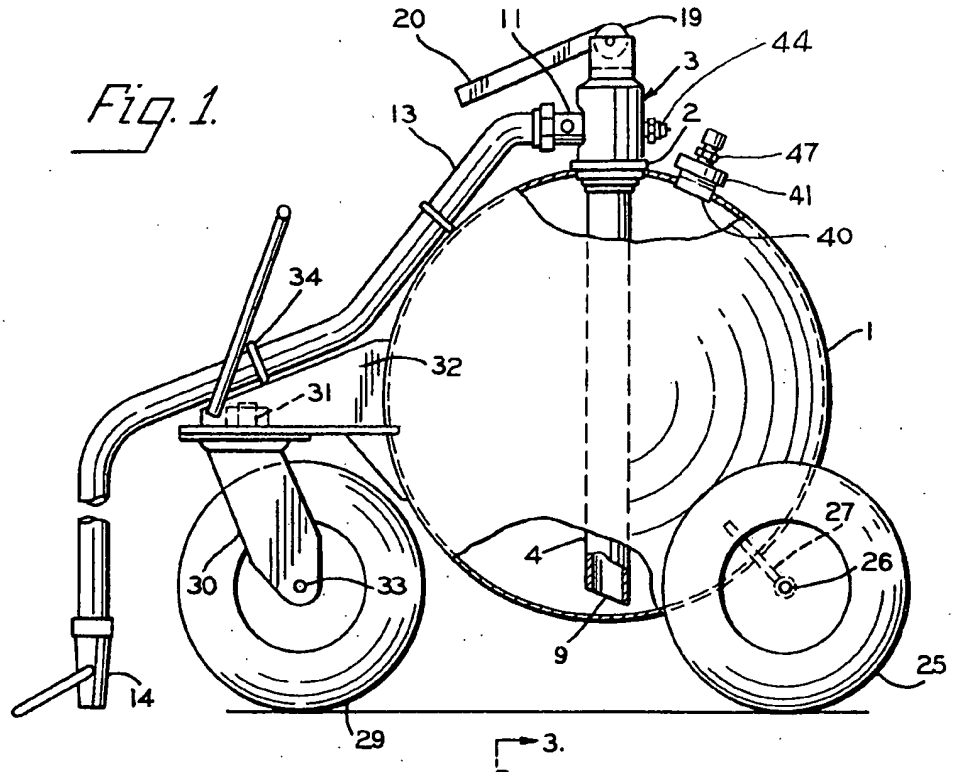


Fig. 2.

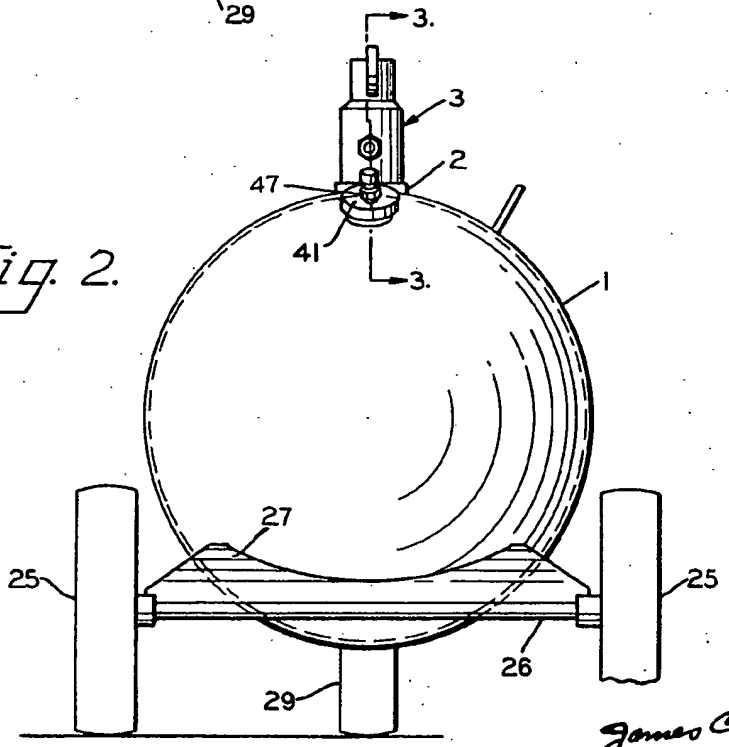


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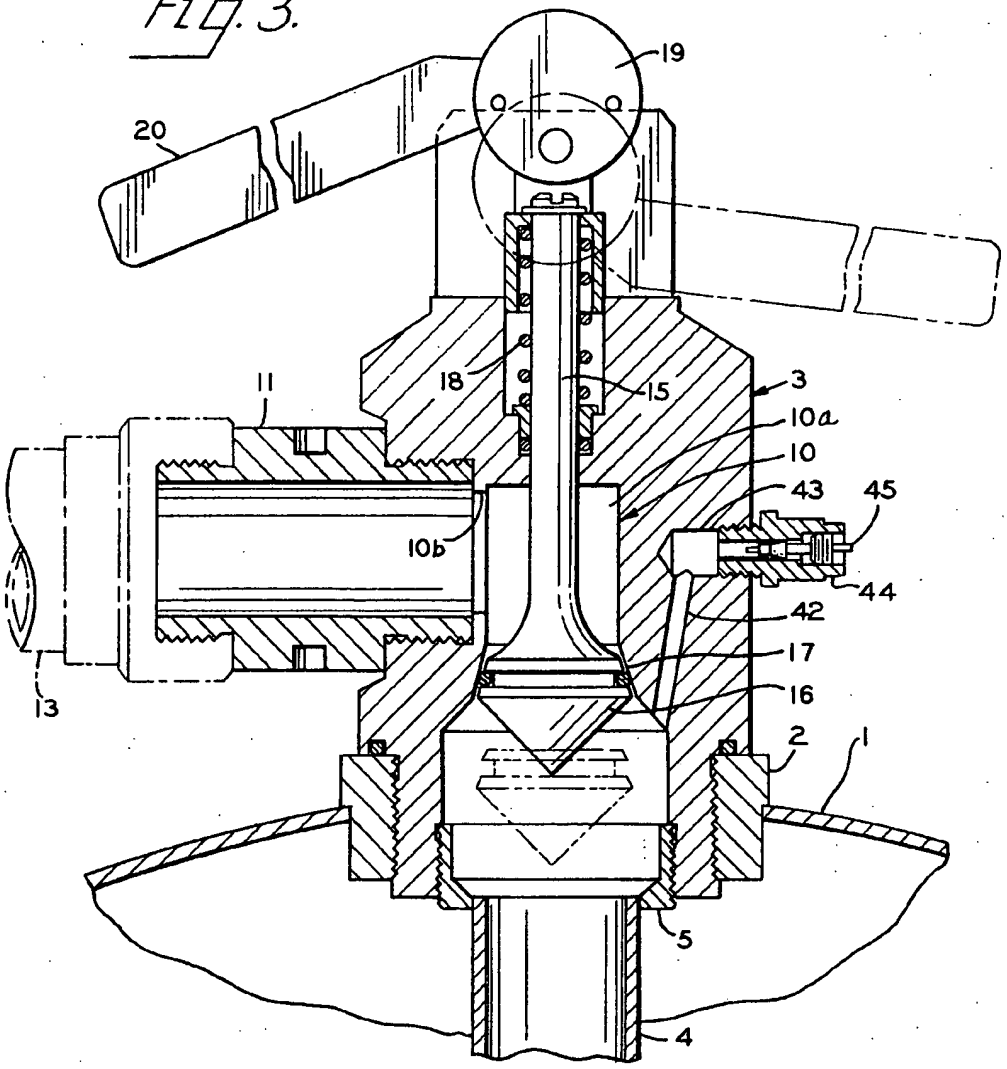
Fig. 3.



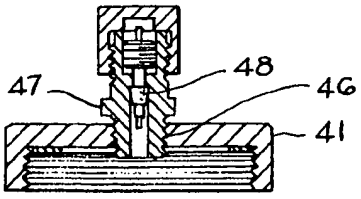


Fig. 4.

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EMERGENCY FIRE EXTINGUISHER

This application is a continuation-in-part of my copending U.S. Pat. application Ser. No. 824,797, now abandoned, filed May 15, 1969, and entitled "Fire Extinguisher."

This invention relates to a fire extinguisher employing dry finely powdered fire extinguishing material.

It is directed specifically to a wheel supported fire extinguisher of the precharged and sealed type so arranged that it may be manually propelled and steered to the site of use, through doors and narrow passageways, around sharp corners, up and down curbs and stairways, and over ledges, by one man, without danger of toppling over, by his pulling on the relatively short discharge hose. As a result it follows the firefighter closely as he moves about performing his usual fire fighting duties.

Heretofore emergency fire extinguishers to be transported close to and about the flame site by one operator and there operated by him have been limited to a size which can be carried about by hand. Such a hand carrier extinguisher is disclosed in U. S. Pat. No. 3,105,458 of R. E. Downham, issued Oct. 1, 1963. Generally they are limited to a maximum weight of 30 pounds.

Large fire extinguishers of the motor truck transported type employing cylindrical and spherical tanks have been provided. In these, pressurized gaseous media for discharging the powder are fed continuously into the tank from a separate storage drum during the discharge of the powder from the tank. The tank is usually mounted on a heavy sled so that it can be dragged onto and off of the motor truck. Spherical tanks used in this type of extinguisher are usually in excess of 3 feet in diameter, and due to their height and the pressure of gaseous media employed, the powder tends to pack in the bottom of the tank. Accordingly, such a spherical tank is generally mounted so that it can be rotated about a horizontal axis for maintaining the powder in loose condition. The powder is discharged through the interior of a hollow axle which supports the tank for rotation. Lateral tubes are arranged in the tank and have inlets near the wall thereof for receiving the powder and admitting it into the interior of the axle.

The prior manually propelled wheel supported extinguishers employ cylindrical tanks. The tank is mounted on a two wheeled hand propelled tilt truck or on a three or four wheeled platform. Some of these tanks are precharged with a charge of powder.

In others pressurized gaseous media are supplied from an adjacent pressurized storage drum.

These types of manually propelled extinguishers have distinct disadvantages. The tanks themselves are tall, heavy and small in diameter relative to height. Since they must operate with the tank in upright position, they have a very high center of gravity.

They are not made to be moved about adjacent the flame site, but to be stored at convenient locations about a building and pushed to a general location a substantial distance from the flame site, there to remain during use. To enable the firefighter to reach the flame site, hoses 30 feet to 50 feet long are provided so that he can reach the site by pulling the hose through doors, windows, and the like, and around corners while the extinguisher itself remains stationary in the selected location.

As to the tilt truck type, an operator must tilt the truck rearwardly, push it to the site, then restore it to upright position so that it will remain in the location to which propelled, and see to it that it does not topple over. Both types are of a size and arrangement meant to employ two men for operation, one to push the extinguishers or ensemble to a general location adjacent the flame and to maintain it upright against inadvertent toppling due to pulling on the hose while the other manipulates the hose. This is because of the inherent instability of the structures, due to their weights, their very high centers of gravity, the relative small supporting wheels with their close spacing relative to tank height and their ground pattern, and the attachment of the hoses to the tops of the tanks whereby the forces imposed by any pull on the hoses are applied far above the centers of gravity and at points of application near the center of the vertically projected patterns defined by the points of engagement of the wheels with the ground. Because of these factors they cannot be propelled and steered by pulling on the hose and thereby made to follow closely behind the operator through doors, up and down stairs and ledges, and around sharp corners, substantially to the flame site. They are entirely too unstable and heavy.

Furthermore, in the upright position of a cylindrical tank, the column of powder is of small diameter and very high relative to its diameter. This ratio combined with the high pressure of the gaseous media necessarily required to apply sufficient force on the top of such a column of powder to force the powder into the bottom of the syphon tube and out through the tube and the hose, compacts the powder to a degree which interferes with the efficient discharge and the desired flow pattern of the powder. Usually, the powder compacts to such a degree that quite generally about 7 percent to 10 percent, and often as much as one-forth, of the charge cannot be discharged by the gaseous media, and accumulates and remains in a mass at the bottom of the cylindrical tank, filling a space beginning at a location directly beneath the inlet of the syphon tube and sloping upwardly and outwardly to the interior of the side wall of the tank. This necessitates an oversize tank for a required powder discharge capacity.

Typical of the hand propelled extinguishers is that shown in U. S. Pat. No. 2,745,700 of J. L. Phalen, issued May 15, 1956. In this structure, due to the small wheels, the bottom of the tank is too close to the ground. The high center of gravity and instability as to toppling render it inoperative for the present purpose.

A type of extinguisher which is mounted on a conventional tilt truck is disclosed in the U. S. Pat. No. 3,058,527 issued to D. H. Dennis et al., issued Oct. 16, 1962. This structure is one employing a cylindrical tank with somewhat hemispherical upper and lower closures at the ends. It is a self-contained pressurized unit with the tilt truck so arranged that, after the unit has been wheeled to a selected location for use, the tilt truck can be tilted upright so that its flat bottom platform rests on the ground with the wheels elevated above the ground and inoperative. It supports the extinguisher tank in its upright position at a fixed location. Its construction precludes its being pulled about by its hose, which is from 30 to 100 feet long and connected to a main valve fitting at the top center of the tank.

In all of these structures the hose is connected at the top to the tank and near the horizontal center of the ex-

tinguisher so that any attempt to propel and steer the extinguisher by pulling on the hose would tilt it forwardly if the wheels were aligned so that their path of travel was parallel to the hose, and turn it over laterally if the direction of pull on the hose were disposed at an angle to the direction in which the wheels are aligned for travel. These extinguishers are not dirigible by pulling on the hose.

These prior extinguishers, larger than the hand carried size, weight 275 pounds and up. They generally hold a charge of 200 pounds or more dry powdered fire extinguishing agent and, of necessity, are generally pressurized at a pressure of about 450 psi in order to expel the powdered agent properly. As far as can be learned, the lowest pressure used in any such wheeled extinguisher on the market is 350 psi. The high pressure is required, as mentioned, because of the shape of the tank which results in a tendency of the powder to pack under its own weight and under that of the air pressure in the cylindrical portion of the container and resist flow to the tube.

The volume of pressurized gaseous media that can be used in such a cylindrical tank is only about 6-1/4 percent of the total charge in the tank, as compared to 20 percent in the present precharged spherical tank. The pressure necessary in a cylindrical tank is about 450 psi., as compared to only 195 psi maximum in the spherical tank.

If the height of the cylindrical tank is increased to accommodate more gas, the center of gravity necessarily is raised and the pressure necessitated by the greater height of the column is increased impeding powder flow. If widened for greater capacity, then more powder is prevented from discharging by packing around the interior peripheral wall of the tank. Furthermore, increases in the diameter of the tank impose progressively increasing ratios of wall thickness to size to withstand the very high gas pressures necessary. This can add appreciable weight, disproportionately large in case of cylindrical tanks, considering that the Interstate Commerce Commission requires that the tanks be constructed to withstand six times their working pressures.

All hand propelled extinguishers must meet rigid requirements of the United States Government and of the Underwriters Laboratory.

The structural features of the prior extinguishers described thus impose a severe limit on the volume of the charge of gaseous media under pressure that can be contained in relation to the amount of powder which can be discharged effectively, and render the prior structures unsuitable for performing the functions of the present invention.

By using a spherical tank of small diameter equipped with a proper wheel support and a properly attached short length of hose, a very light weight precharged fire extinguisher of large capacity can be provided which can be manually propelled and steered by one man pulling on the hose, so as to follow the firefighter closely through doors, narrow passageways, up and down stairs, ledges, and curbs, around sharp corners, over rough terrain, and close to the fire site without danger of upsetting. As a result, all of his time and attention can be directed to fighting the fire, rather than to trying to position the extinguisher at the required location by repeated trials and trips back and forth to reposition the extinguisher and again relocate the discharge end of its hose by extending a long hose.

Furthermore, with such a spherical tank of small size, but having a volumetric discharge capacity equal to that of the presently used cylindrical tanks of wheel supported extinguishers, a larger proportion of gaseous media to powder can be contained; for example, gaseous media in the amount of about three times that used in a cylindrical tank employing a like powder charge. In the spherical tank, the gaseous media can be under less pressure because, due to the shape of the spherical tank, the powder is in a mass having a low height to diameter ratio, and therefore is under less resistance to flow and less compaction by the gaseous pressure. Furthermore, a much shorter siphon tube can be used, reducing resistance to flow and facilitating recharging. The frictional resistance to the flow of the powder is so reduced that it readily feeds down the sides of the spherical tank to the inlet end of, and up through, the relatively much shorter syphon tube. Substantially all of the powder can be discharged by the single precharge of gaseous media with sufficient media remaining to blow the syphon tube, valve, and short hose clear of residual powder.

The extinguisher can be depressurized in its upright position for recharging with powder, and can be repressurized by air at less than 200 psi pressure, an air pressure readily available in manufacturing plants.

The wheel structure and interrelation of parts is such that the extinguisher is exceedingly stable when pulled about by its hose.

Other specific objects and advantages of the invention will become apparent from the following description wherein reference is made to the drawing in which:

FIG. 1 is a side elevation of a fire extinguisher embodying the principles of the present invention, part thereof being shown in section for clearness in illustration;

FIG. 2 is a rear elevation of the structure illustrated in FIG. 2;

FIG. 3 is an enlarged fragmentary vertical sectional view of the extinguisher, and is taken on the line 3—3 of FIG. 2; and

FIG. 4 is a vertical sectional view of the detachable charging cap and its valve, for charging, pressurizing, and depressurizing the extinguisher.

Referring to the drawings, the fire extinguisher comprises a spherical tank 1 which has an opening in the top in which an internally threaded collar 2 is permanently installed in sealed relation to the wall of the tank. A discharge head 3 is detachably mounted in the collar 2 in sealed threaded engagement therewith.

A syphon tube 4 is supported by the head 3 in generally upright position by means of an externally threaded sleeve 5 fixedly secured to the upper end of the tube 4. The lower end of the tube 4 extends very close to the bottom of the spherical tank 1 and is beveled, as indicated at 9, for assuring an adequate inlet into the tube for the powdered extinguishing material as it feeds downwardly and inwardly of the tank toward the tube.

The head 3 has a through passage 10 comprising an upright bore 10*a* and a lateral bore 10*b*. The outlet of the lateral bore 10*b* is connected by a suitable fitting 11 to a discharge hose 13 which has a conventional discharge control nozzle 14 at its outer end.

A suitable stop valve 15 is mounted in the head 3 and has a plug 16 which, in the closed position of the valve, seats on a seat 17 in the head 3 and thereby prevents the flow of gaseous media and powder from the upper

or outlet end of the syphon tube 4 out through the lateral passage 10*b*.

The valve 15 is normally held in closed position by a spring 18 and may be moved to open position by an eccentric cam 19 manually operable by a handle 20. The cam is so arranged that when moved to position to open the valve, it passes dead center and retains the value in open position, and thereupon further control is effected by the valve 14.

The hose 13 is relatively short; for example, not to exceed about 15 feet. As a result, the fire fighter is always close to the extinguisher during its use. The extinguisher is designed to be pulled about and steered by the firefighter himself, by means of pulling on the hose.

It has been found that with a spherical tank and structure of this type, substantially all of the contained powder moves down readily along the interior walls of the tank and to the inlet of the syphon tube 4 without packing, and can be expelled in its entirely from the tank through the short tube 4 by the original charge of gaseous media at lower pressures than heretofore believed possible in connection with the wheel supported manually propelled extinguishers.

In order to assure that the extinguisher can be propelled by pulling on the hose without danger of tipping over or upsetting, the extinguisher is provided with three wheels, including a pair of coaxial rear wheels 25. The wheels 25 are arranged on a suitable shaft 26 which is fixedly secured by brackets 27 to the bottom portion of the tank 1 near the rear thereof. These wheels 25 generally are positioned a short distance outwardly beyond the lateral limits of the tank 1 and with their peripheries extending beyond the rear of the tank. The third wheel is a caster wheel 29 and is mounted in a suitable yoke 30, having a generally upright pintle 31 which swivels in a supporting bracket 32. The pintle axis is located a substantial distance forwardly from the front of the tank. The horizontal rotational axis 33 of the wheel 29 is offset in a direction rearwardly from the swivel axis so that the wheel is self-steering in response to forces imposed when the extinguisher is propelled by pulling on the hose. The wheels are arranged in a triangular pattern.

The center of gravity of the extinguisher is generally near or slightly below the level of the center of the spherical tank. However, the connection of the inlet end of the hose to the head 3 is well above the center of gravity. In order to direct properly and below the center of gravity the line of force resulting from pulling endwise on the hose for propelling the extinguisher, the hose is mechanically secured to the bracket 32 forwardly from the tank, close to the level of the tank center, as illustrated, or therebelow, and preferably substantially at or close to, the swivel axis of the pintle 31 by a clamp 34. It may be secured somewhat forwardly of the pintle axis, but such leads to increasing the fore and aft length of the extinguisher, which impedes it in turning in closely confined spaces.

As a result of this arrangement an operator standing at normal height can grip the hose and pull endwise thereon forwardly to propel the extinguisher forwardly, or pull laterally of the extinguisher and thus change its course, so that it follows the fireman closely around sharp corners, up and down stairways, through narrow doors and passages, over ledges, curbs, and rough terrain without interferring with his fire-fighting duties. When so propelled by the hose the extinguisher first adjusts itself to face in the proper direction, caster wheel foremost, by swinging about an upright axis between the wheels until the caster wheel 29 is in a line midway between the wheels 25 and extending generally endwise of the hose. The propelling force imposed by the hose when being used to pull the extinguisher passes below the center of gravity of the fire extinguisher and has little or no tendency to upset the extinguisher.

Furthermore, since the hose is connected forwardly of the tank and the horizontal rotational axis of the caster wheel, and preferably substantially at the axis of its pintle, any pull on the hose laterally of the path of travel of the extinguisher is effective to steer the extinguisher into a new course parallel to the new line of force, and no part of this pulling force imposes components on the extinguisher which tend to drag it sidewise and upset it, as they would, for example, if the new line of pull fell considerably to the rear of the axis 33 or front of the tank 1. The fire extinguisher can readily be propelled by the one fireman, even over relatively rough and circuitous paths, without danger of tipping over, simply by pulling on the hose in the customary fashion he would employ to maneuver the nozzle to the desired location relative to the fire site.

Thus, the spherical tank combines low center of gravity with accompanying stability and less weight, shorter siphon tube, ready flow of a larger effective charge of powdered material by a precharged supply of gaseous media under lower pressures than heretofore used, discharge of substantially all of the powdered material and scavenging of the valve and hose with the residue of the original supply of gaseous media.

A typical charge in the present instance may comprise a powder of pure ammonium phosphate which has been treated with silicon to render it free flowing and nonhydroscopic. Aside from the purity, the particle size is a maximum of 16 microns, as compared to 19 to 24 micron size particles commonly used in prior extinguishers.

The spherical tank is preferably about 22 inches in diameter and employs a syphon tube of about 1-1/4 inches in diameter. Such a tank can carry a charge of about 150 pounds of powder of which over seven-eighths can be discharged in as short a time as 35 seconds by the original precharge of gaseous media. It can discharge a total of 99 percent of a charge of 150 pounds, even at temperatures as low as 40° F. below zero.

The pressure of the gaseous media is about 195 psi, as compared to the usual pressure of 450 psi and up.

The wheels preferably are of a diameter about equal to the radius of the tank so that they can climb curbs and stair steps readily, and can ride into and out of the usual chuck-holes in pavements and factory yards without tipping. Further they support the tank with its bottom several inches above the ground, so that it can pass over curbs of the heights required by authoritative specifications.

The simple rigid threaded connection between the syphon tube and the tank can be used because the tube is short and does not have to be rocked laterally about a point near the top of the tank in order to make it penetrate the much less depth of the charge of powdered material made possible by the use of the spherical tank.

The tank can be charged with powder by removing the head 3 and syphon tube 4. Preferably, however, the tank is provided near the top with a threaded collar 40,

which is closed by a detachable cap closure 41. The powder can be introduced through the collar 40 without detaching the syphon tube and discharge head 3.

Further, the head 3 is provided with a charging duct 42 for pressurizing it with gaseous media. The duct 42 is in communication with a passage 43 leading to the outside of the head. The duct 42 opens into the head between the open outlet end of the syphon tube 4 and the valve plug 16 in the closed portion of the valve plug 16 so that pressurized gaseous media delivered through the passage 43 can enter the spherical tank through the syphon tube 4 and thus blow back into the tank any of the powdered material that may happen to remain in the syphon tube after use in those instances in which the entire charge was not used in a prior operation.

In order to facilitate the pressurizing in this manner, a suitable filling stem 44 is provided on the head 3 and is in communication with the passage 43 for receiving the gaseous media under pressure and directing it into the tank. A suitable check valve 45 is mounted in the tube 44 or passage 43, as desired, and opens inwardly thereof upon the introduction of gaseous media under pressure to the outer end of the tube 44, and closes so as to retain the charge of compressed gaseous media within the tank. The valve 45 may be of the type commonly used in high pressure motor vehicle tires.

Ordinarily, the entire charge of powder can be expelled forcibly by the original charge of pressurized gaseous media. However, there is always the possibility of loss of some of the media and a resultant drop in pressure by improper closing of the nozzle valve 14 or main valve 15, or by a loose connection of the hose 13, or by the development of minute leaks in the hose 13. In such cases it may become desirable to pressurize the tank without blowing back through the syphon by way of the passage 42. Quite often, when thus blowing back, the extinguisher must be tilted on its side so that the powder charge is below the level of the inlet of the syphon tube. On the other hand, the leakage may deplete the pressure while the tank is nearly full and the inlet of the syphon cannot be uncovered by tilting.

Also, for servicing and various other reasons, it may become necessary to depressurize the tank from above the level of the powder.

To permit repressurizing the tank while it remains upright, and to permit depressurizing the tank without disturbing the powder charge, the cap 41 is provided with a check valve and fitting, such as that provided for the by-pass duct 42.

As illustrated in FIG. 4, the cap 41 has a passage 46 therethrough and a filling stem 47 is secured therein. The stem 47 carries a check valve 48, the same as the valve 45 heretofore described.

With the valve 48, the tank can be pressurized and depressurized, as required, without disturbing the charge.

Since the pressure required does not exceed 200 psi, the pressurized air supply generally available in manufacturing plants is adequate so that the extinguisher can be serviced at the plant in which located.

For recharging the tank, all that is necessary is to depress the valve 48 until the tank is depressurized, then remove the cap 41, introduce the requisite charge of powder, replace the cap 41, and then introduce an adequate quantity of precharging gaseous media into the interior of the tank through the stem 47 or stem 44.

As mentioned heretofore, Government specifications and Fire Underwriters Laboratory requirements must be met, and these are generally severe. If not met, the product will not be marketable. The Government insists on stability of the extinguisher against tipping. No toppling during use or propulsion is permissible.

It is to reduce the possibilities of toppling that pneumatic tired wheels of 12 inch diameter are used and that the spherical tank with its lower center of gravity and lightness is used. A comparable size tank in cylindrical form has too high a center of gravity, and due to flow characteristics in such a cylindrical tank, it must have a large height to diameter ratio, else a sufficient amount of its charge could not be expelled. Even with the best of cylindrical tanks, an increase in size greater than desired is necessary because only about 75 percent to 90 percent of the powder can be expelled, and a minimum volumetric discharge is generally necessary.

Furthermore, the Underwriters Laboratory and Government specifications are such as to require a so-called "drop test." In this test, the extinguisher is propelled forwardly off of the edge of a horizontal platform 12 inches above the floor. Without any extraneous assistance, it must land, and remain, upright.

Also, it must be capable of being propelled forwardly up or down curbs as high as 3 inches at 10 m.p.h. without upsetting.

The Interstate Commerce Commission's requirements are that the tank be capable of withstanding six times the working pressure. Any appreciable increase in tank size requires not only more wall area, but much thicker walls. The low pressure made possible by the spherical tank makes possible a great reduction in wall thickness; for example, to withstand a maximum of about 6 × 200 or 1,200 psi, as compared to 6 × 450 or 2,700 psi.

These requirements cannot be met by any wheeled extinguisher employing wheels of relatively small diameter relative to the tank diameter and height, — such, for example, as that disclosed in the above identified U. S. Pat. No. 2,745,700. The wheels, the caster wheel in particular, must be of relatively large diameter to negotiate the curb, and to assure that the bottom of the tank will be sufficiently elevated to clear the top of the curb and like obstructions, such as the rim of chuck holes.

The present extinguisher, using a spherical tank, makes possible a greater useful charge, a larger gas to charge ratio, reduced gas pressure, limited height and thinner walls, smaller size, less weight, low center of gravity, with greater mobility, such that it can be maneuvered readily without toppling over by one person using only the hose for applying the propelling and steering force.

The structure dimensionally described has a total weight, charged, of only 275 pounds, about 170 pounds less than the wheeled manually propelled extinguishers available on the market, and this is made possible largely by the spherical shape of the tank.

The wheeled manually propelled extinguishers available on the market require removal of the syphon tube for recharging with powder. Before replacing such a tube, all threads and seals must be cleaned and lubricated and the tube rocked to and fro to sink it through the powder. With the present structure, the tank, tube and valve can be blown clean by pressurized gaseous media introduced through the valve 48, while the sy-

phon and cut-off valve remain in place, the tank then depressurized, the filling cap removed, the tank charged with powder, the filling cap replaced, and the tank pressurized through the valve 48.

There is adequate gas under pressure, even allowing for normal leakage during use, to discharge all of the powder and purge the tube, hose and valves, which, if not done, causes them to gum up, usually to an extent such that the hose must be replaced.

Should some accident cause too great a loss of pressurized gas, the tank can be pressurized immediately through the valve 48.

Having thus described my invention, I claim:

1. A manually propelled pre-pressurized fire extinguisher for discharging dry chemical extinguishing composition, and comprising:

a spherical pressure tank;

an up-right syphon tube connected in sealed relation in the tank and having an open lower end near the bottom of the tank and an open upper end at the top of the tank;

the interior of said tank being open and unobstructed from the top to the bottom so as to permit the free flow to the open lower end of the syphon tube of flowable fire extinguishing powder introduced in the tank;

a discharge head connected to the tank at the top of the tank and having a passage therethrough with one end in communication with the tube;

a discharge hose connected at one of its ends to the head and in communication at said one end with the other end of said body passage, and being operative to discharge into the atmosphere at the opposite end of the hose;

a stop valve in the head for opening and closing the passage therethrough, selectively;

wheels connected to the tank and arranged to support the tank for rolling along a supporting surface in upright position, said wheels being three in number and arranged in a triangular pattern in which two wheels are at the lower rear of the tank in coaxial relation with each other, and the third wheel is a caster wheel positioned forwardly of the tank and having a generally upright swivel axis disposed forwardly from the tank and lying in a plane normal to the axis of said two wheels midway between the two wheels and having a horizontal rotational axis spaced rearwardly from the swivel axis in the normal position the caster wheel assumes when the extinguisher is being propelled forwardly;

means to admit gaseous media under pressure into said tank and to confine it therein so long as said stop valve is closed;

securing means securing said hose, at a portion spaced from the head to the extinguisher at a location which is in said plane and closer to said axis than to the tank, and at an elevation such that a pull endwise on the hose by an operator walking upright imposes a propelling force on the tank below the center of gravity of the tank so that by pulling on the hose the tank can be propelled without danger of overturning; and

said extinguisher being sufficiently light in weight so that it can be propelled readily by one man by his pulling on the hose;

means to admit gaseous media under pressure into said tank and to confine it therein so long as said stop valve is closed;

securing means securing said hose, at a portion spaced from the head to the extinguisher at a location which is in said plane and closer to said axis than to the tank, and at an elevation such that a pull endwise on the hose by an operator walking upright imposes a propelling force on the tank below the center of gravity of the tank so that by pulling on the hose the tank can be propelled without danger of overturning; and

said extinguisher being sufficiently light in weight so that it can be propelled readily by one man by his pulling on the hose.

2. The structure according to claim 1 wherein the securing means secures said portion of the hose to the extinguisher forwardly from the horizontal rotational axis of the caster wheel in the normal position the caster wheel assumes when the extinguisher is being propelled forwardly.

3. The structure according to claim 2 wherein the securing means secures said portion of the hose to the extinguisher substantially at said swivel axis.

4. The structure according to claim 1 wherein the head has a valve seat;

a closure plug is disposed within the head and is seated on the seat when the valve is in closed position;

said head has a charging passage for gaseous media opening at one end at the exterior of the head and in by-passing relation to the valve for admitting said gaseous media under pressure into the tank when the valve is closed;

and a check valve is connected to the head and operable when open to open to admit gaseous media under pressure through the inlet passage and operable when closed to seal the charging passage.

5. The structure according to claim 1 wherein the tank has a filling opening near the top and spaced from the head, and a closure member is detachably connected to the tank in sealed relation to said filling opening.

6. The structure according to claim 5 wherein said closure member has a passage therethrough for gaseous media; and

a check valve opening inwardly of the tank is mounted in said passage.

7. The structure according to claim 1 wherein said tank contains, when in sealed condition, a charge of dry flowable fire extinguishing powder in an amount filling the tank from the bottom partway toward the top and contains, in the space in the tank above the material, a precharge of gaseous media under sufficient pressure and in an adequate amount to discharge all of said charge from the container through the tube when the stop valve is open and to purge the tube, head passage, and hose of residual powder.

8. The structure according to claim 7 wherein the fill precharge in the tank is about 80 percent extinguishing powder and about 20 percent gaseous media.

9. The structure according to claim 1 wherein the wheels are of a diameter approximately equal to the radius of the tank.

10. The structure according to claim 1 wherein said tank has an opening in its wall near its top;

an internally threaded collar is secured to the wall in sealed relation about the opening;

said head has a threaded portion secured in sealed, threaded relation in the collar, and

said head has an internally threaded portion coaxial with the collar, and the upper end of the syphon tube is in direct threaded engagement with said internally threaded portion and is held thereby with the tube in fixed upright operating position in the tank.

11. A fire extinguisher comprising:

a container for fire extinguishing material supported by a front caster and two rear wheels,

valve means fixed in fluid communication with the container for opening and closing a passage for the fire extinguishing material,

the passage extending from near the bottom of the container through the valve means to a hose connected to the valve means,

a frame fixed to the front of the extinguisher,

guide means secured to said frame for turning the front of the fire extinguisher toward an operator in response to his pull of the hose.

12. A fire extinguisher comprising:

a container for fire extinguisher material;

a front caster wheel and two rear wheels supporting the container and arranged in a triangular pattern, the caster wheel being positioned at the front of the extinguisher and near to the front of the container, having its swivel axis disposed forwardly from the container, and having its horizontal rotational axle spaced rearwardly from the swivel axis in the normal position the caster wheel assumes when the extinguisher is being propelled forwardly;

an elongated discharge hose having a discharge end;

means connecting the hose to the extinguisher so that the hose can receive material from the lower portion of the container and so that a portion of the hose is in fixed position relative to the swivel axis of the caster wheel and is near the position, forwardly and rearwardly of the extinguisher, of the rotational axis of the caster wheel in said normal position of the caster wheel, for thereby causing the front of the extinguisher to turn toward an operator in response to a pull by the operator on the hose, near the discharge end thereof, sufficient to propel the extinguisher by the hose in the direction of pull; said portion being at a height above the bottom of the wheels, when the wheels are on the ground, such that the line of force of said pull on the hose is directed below the center of gravity of the container; and

said fire extinguisher being sufficiently light in weight so that it can be propelled by a single operator applying said pull by holding onto the hose near its discharge end while walking generally upright in a direction away from the extinguisher.

13. The structure according to claim 12 wherein the container is spherical.

14. The structure according to claim 13 wherein the container is positioned so that, with the wheels resting on the ground, the bottom of the container is disposed below the level of the top of the wheel rims.

15. The structure according to claim 12 wherein said connecting means includes a valve connected to the top of the container and having an outlet connected to the inlet end of the hose and an inlet connected with a siphon tube leading to near the bottom of the container.

* * * * *

US005855386A

United States Patent [19]

Atkins

[11] Patent Number: 5,855,386

[45] Date of Patent: Jan. 5, 1999

[54] **VEHICLE**

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[73] Assignee: **Terrapid Technologies CC**, South Africa

[21] Appl. No.: **731,260**

[22] Filed: **Oct. 11, 1996**

[30] **Foreign Application Priority Data**

Oct. 11, 1995 [ZA] South Africa 95/8561

[51] **Int. Cl.**[6] **B62D 7/16**

[52] **U.S. Cl.** **280/124.111**; 280/124.169; 280/93.51; 180/400

[58] **Field of Search** 280/660, 664, 280/671, 717, 695, 700, 691, 111, 771, 93, 96, 846, 93.502, 93.51, 124.169, 124.177, 124.134, 124.135, 124.11, 124.111; 180/78, 400; 267/265, 267, 263, 269, 276, 277, 52, 279

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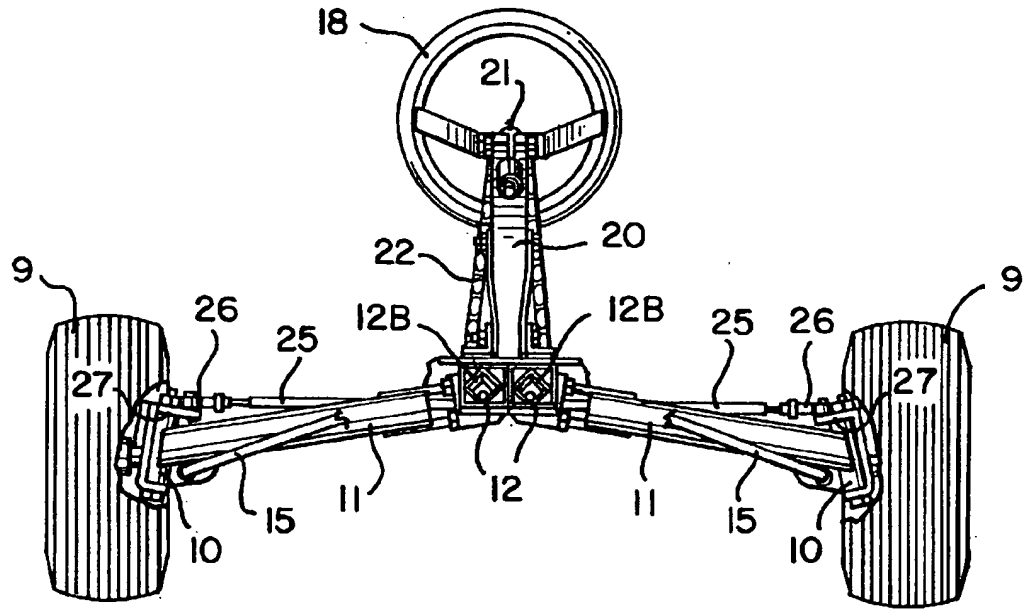
Primary Examiner—Paul N. Dickson

Attorney, Agent, or Firm—Darby & Darby

[57] **ABSTRACT**

A front suspension unit for the independent suspension of the front wheels of a motor powered off road four wheel vehicle comprising a pair of suspension units with their outer casings mounted together and the inner members carrying laterally extending arms with their free ends constituted for attachment to front wheel mounting assemblies and such units in combination with a steering assembly having a column to be supported at one end from the vehicle chassis and carrying a steering wheel and axle on the other end, the axle having a chain and sprocket mounted thereon with the ends of the chain attached to a plate rotatably mounted on the column and carrying link arms to be attached one to each of the front wheel mounting assemblies.

9 Claims, 5 Drawing Sheets



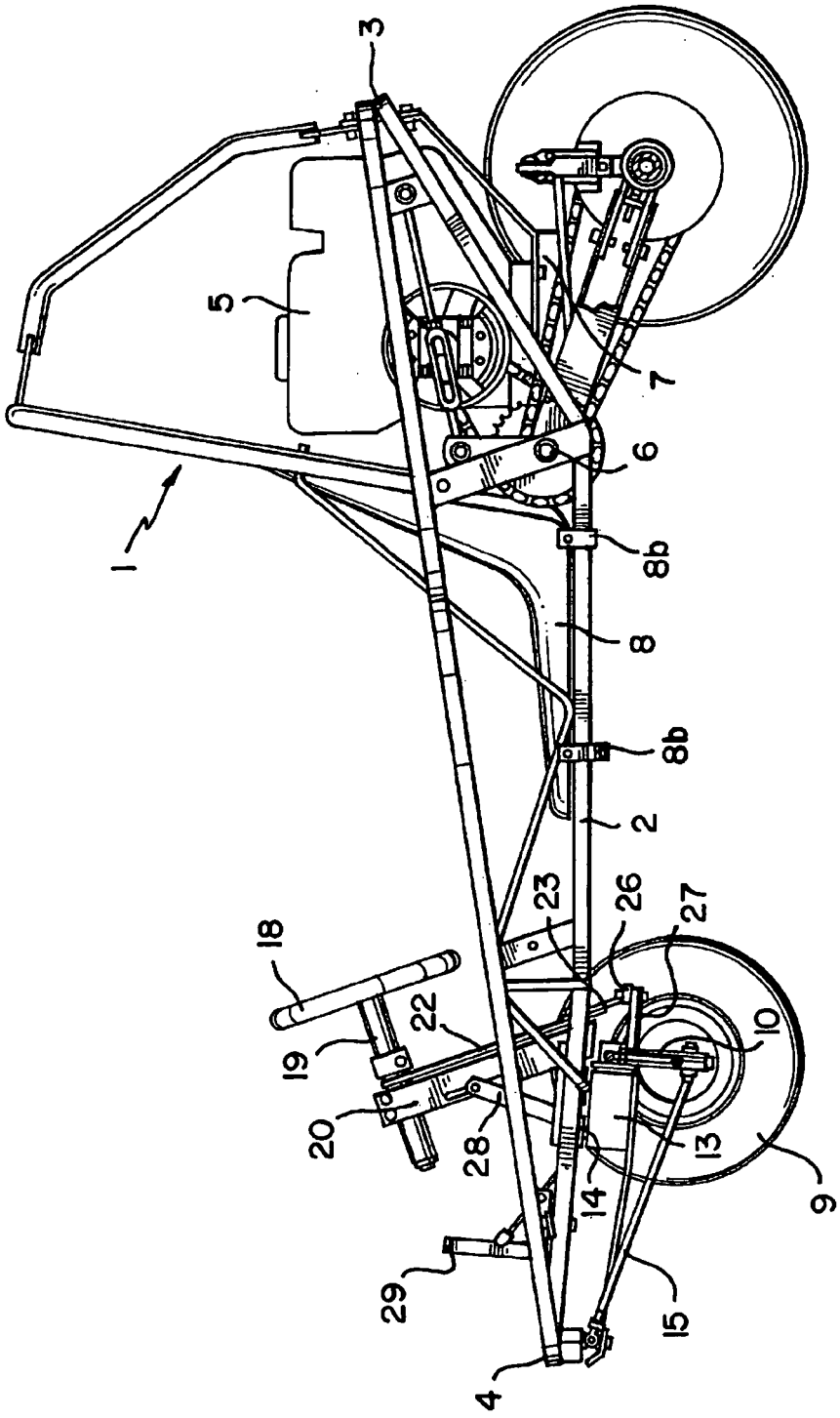


FIG. 1

FIG. 2

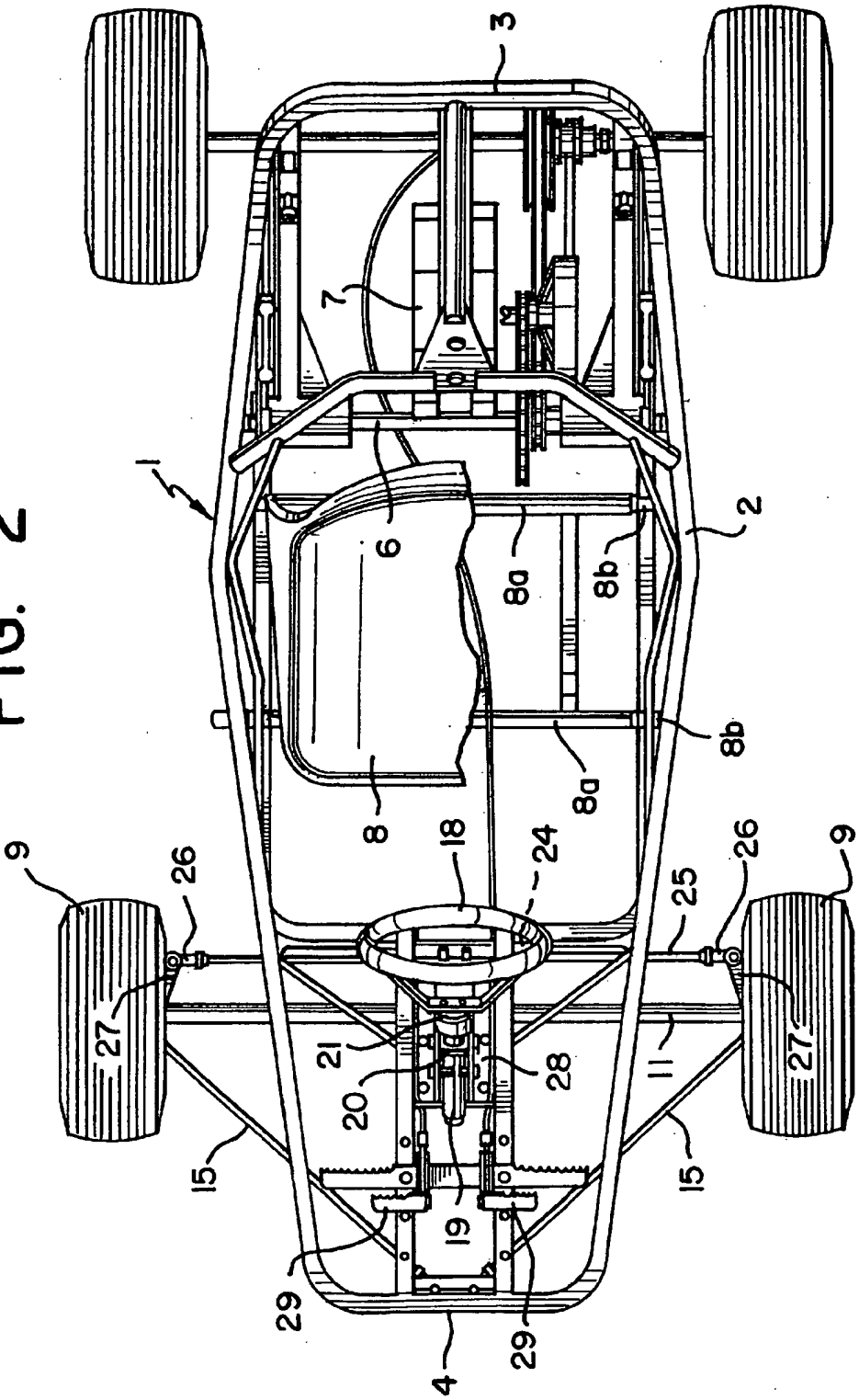


FIG. 3

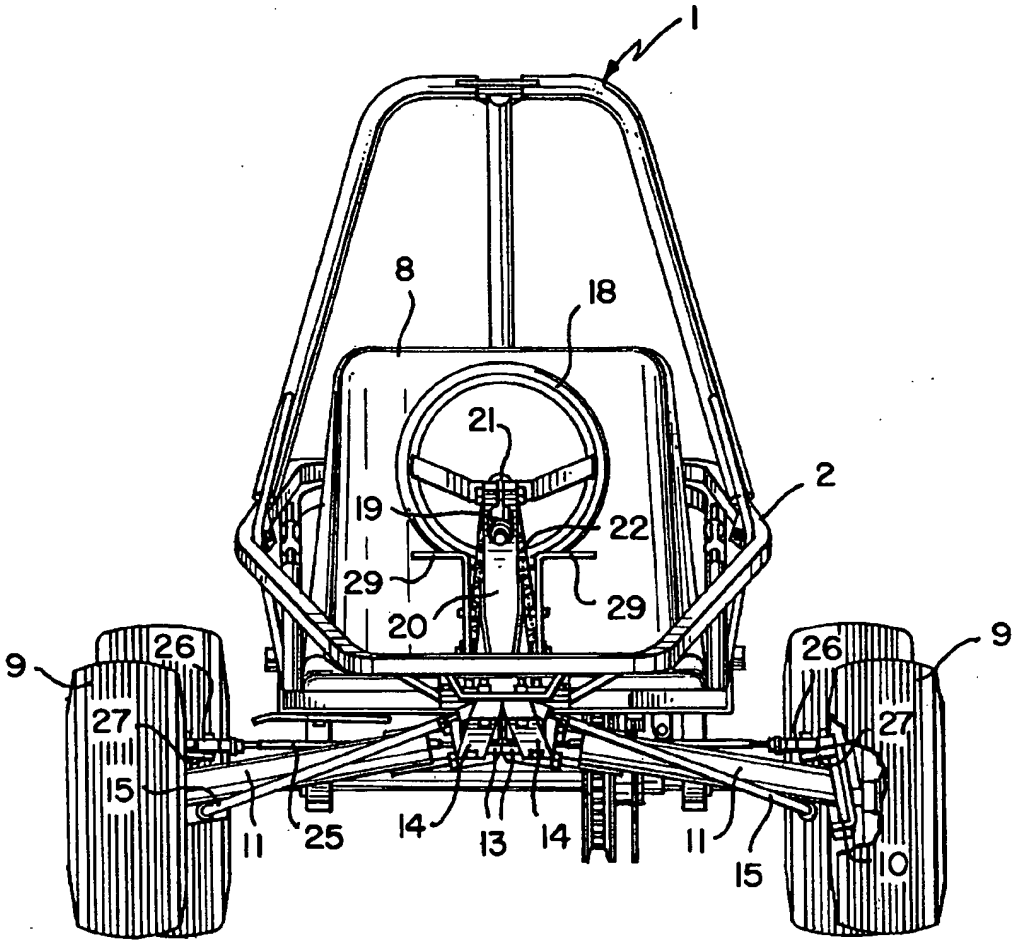


FIG. 4

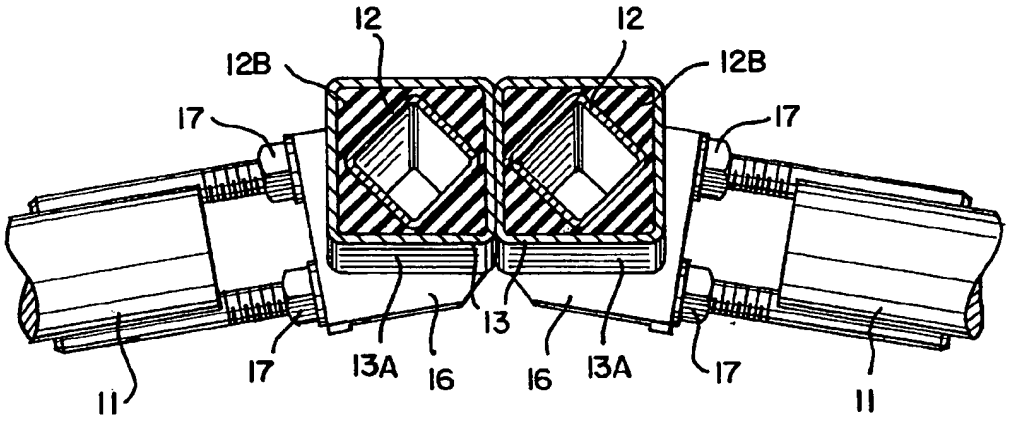

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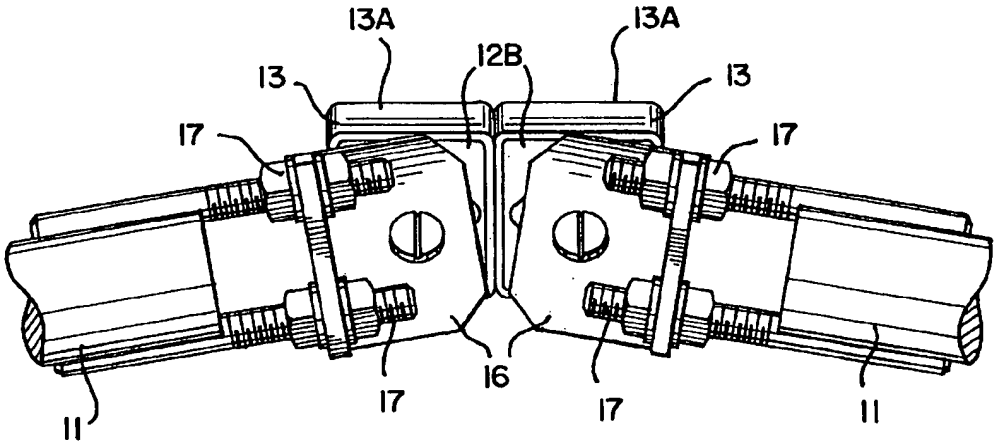
FIG. 5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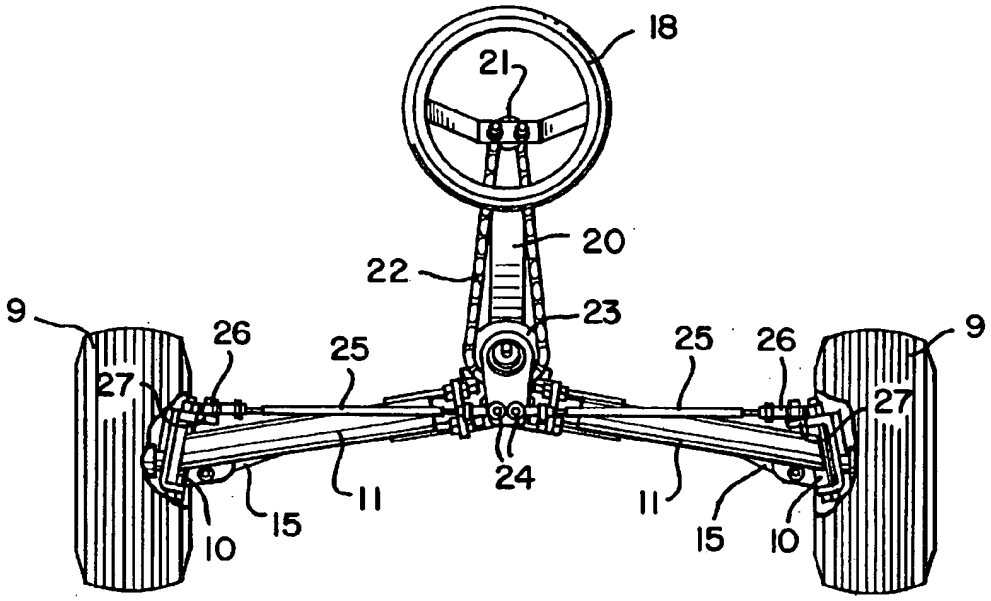
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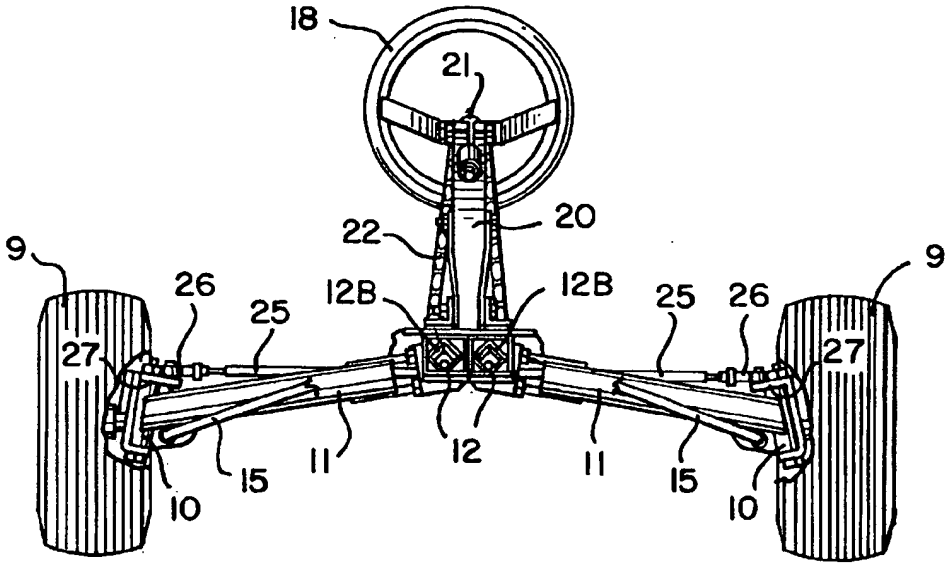
FIG. 7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VEHICLE

INTRODUCTION

This invention relates to a vehicle and more particularly to small motor driven vehicles such as those known as go-karts and golfers caddy carts for example.

BACKGROUND OF THE INVENTION

Small vehicles of the kind referred to are becoming more and more popular for recreational and other general purpose off-road usage. In general the vehicles lack adequate suspension units to enable them to be used at speed unless they are driven on flat and smooth prepared tracks. This is a severe limitation and removes much of the pleasure to which they could otherwise be put.

OBJECT OF THE INVENTION

It is the object of the present invention to provide a vehicle which will overcome the above disadvantages to a large degree.

SUMMARY OF THE INVENTION

According to this invention there is provided a motor powered off-road four wheeled vehicle having a front wheel suspension provided through a pair of suspension units of the type having a resilient member, which can be in block form, between an inner member and an outer casing with the outer casings of the units mounted together centrally of the chassis and for the inner members to carry laterally extending arms terminating in wheel mounting assemblies.

Further features of this aspect of the invention provide for the wheel mounting ends of the arms to be braced by stays extending forwardly and inwardly to points on the chassis substantially in line with the suspension units and for the stays to have swivel joints at their connection points.

Another aspect of this invention provides steering for the front wheels comprising a mounting column supported on the chassis and carrying a steering axle and bush having a chain and sprocket to provide the steering movement through link arms extending to the wheel mounting assemblies.

Further features of this aspect of the invention provide for the inner ends of the link arms to be mounted through swivels to a plate or sprocket rotatable by the chain, for these mountings to be close to the centre line of the vehicle at the height of the centre line of the suspension units, and for the outer ends of the link arms to be connected to rearwardly extended members rigidly connected to the wheel mounting assemblies.

The invention also provides for the mounting column to be pivotally supported on the chassis and located by an adjustable stay extending between the column and the chassis forward of the column.

BRIEF DESCRIPTION OF THE DRAWINGS

The above features and many other will become apparent from the following description of one example of the invention. In this description reference will be made to the accompanying drawings in which

FIG. **1** is a side elevation of the vehicle;

FIG. **2** a plan view;

FIG. **3** is a front view;

FIGS. **4** and **5** are details of components of the vehicle; and

FIGS. **6** and **7** show the steering mechanism for the vehicle.

DETAILED DESCRIPTION OF THE DRAWINGS

As illustrated the invention is applied to a vehicle which illustratively is an off-road go-kart.

The vehicle indicated generally at **(1)** in the accompanying drawings has a chassis **(2)** fabricated from suitable bent and welded hollow steel tubing. The chassis **(2)** has a generally upwardly inclined rear end **(3)** and inwardly tapered front end **(4)**.

A conventional motor **(5)** in the form of internal combustion engine is mounted in a cradle formed by a lay shaft **(6)** and a bracket **(7)** so that the motor is bolted in position in the chassis **(2)** by a single bolt at the rear of the chassis through the bracket **(7)** and bolts onto the lay shaft **(6)**.

A driver's seat **(8)** is mounted to the chassis **(2)** forward of the motor **(5)** and this seat is adjustable along the length of the chassis **(2)**. The seat is supported on rollers **(8*a*)** carried by clamps **(8*b*)** securable to the chassis by means of a spring-loaded indent pin in well known manner.

The front wheels **(9)** are each mounted on stub axle and king pin assemblies indicated at **(10)**. Each king pin assembly **(10)** is carried by an arm **(11)** which has its end remote from the king pin assembly **(10)** secured to the inner member **(12)** of a suspension unit **(13)**. (See FIGS. **4** and **5**) of the type having at least one resilient element, such as a block **12B**, between an inner member **12** and an outer casing **13A**.

The outer casing of each suspension unit is secured through plates **(14)** to the chassis **(2)**. The two outer casings are mounted against each other on either side of the longitudinal axis of the chassis **(2)**.

Bracing stays **(15)** extend between the front of the chassis **(2)** to the ends of each arm **(11)** and the connections at the ends of the stays **(15)** are effected through universal swivel couplings. The forward ends of stays **(15)** are substantially in line with the suspension units **(13)**.

The assembly above described affords independent suspension for each front wheel and the mounting to the chassis through the plates **(14)** enables the front wheel assembly and suspension to be removed as a unit from the chassis **(2)**.

As can be seen from FIGS. **4** and **5** the arms **(11)** are connected to the inner members of the suspension units through angle brackets **(16)** and a pair of bolts **(17)**. By separately setting the individual bolts **(17)** of each pair, the loading of the arms **(11)** through the suspension units **(13)** can be easily adjusted to suit the load on the vehicle and terrain over which it is to be driven.

Steering for the vehicle is provided by a steering wheel **(18)** supported on a shaft **(19)** carried in a mounting plate **(20)**. This is illustrated in FIGS. **6** and **7**.

The shaft **(19)** has a sprocket **(21)** secured thereto which co-operates with a chain **(22)** which has its ends anchored to opposite sides of a rotatably supported plate in the form of a disc **(23)**. The disc **(23)** is connected by means of swivel joints **(24)** to link arms **(25)** having their opposite ends connected also through swivel joints **(26)** to rearwardly extending members **(27)** rigidly connected to the king pin assemblies **(10)**.

The swivel joint connections **(24)** to the disc **(23)** are located at the same height and substantially in line with the centre lines of the suspension units **(13)**.

The mounting plate **(20)** is pivotally supported on the chassis **(2)** and braced by a bracket arrangement **(28)** which allows the steering wheel position to be adjustable. Also this

arrangement enables the steering assembly to be easily removed from the vehicle as a unit.

Pedals (29) are pivotally mounted on the chassis and the pedal arms used to operate Bowden cables. One cable is used to operate the motor accelerator and the other to operate the disc brake assembly as described above.

The construction described above enables components of the vehicle to be of substantially modular construction which facilitates both assembly and repair. The vehicle is also robust and the various features enable it to be economically manufactured while providing a unique construction for vehicles of this kind.

It will be appreciated that many variations and modifications to the details of construction set out above can be made without departing from the scope of this invention. Protection roll bars may be included and the design shape of the chassis varied to suit requirements. Also the vehicle may be modified from the go-kart described to be suitable as a golfers caddy cart or some other low speed vehicle to be used over uneven terrain.

What I claim as new and desire to secure by Letters Patent is:

1. A front suspension unit for the chassis of a motor powered off road four wheeled vehicle comprising:

a pair of suspension units each including at least one resilient block between an inner member and an outer casing with the outer casings of said units mounted together;

the inner member of each unit carrying a laterally extending arm having a free end constructed to terminate in a front wheel mounting assembly; and

stays, each having one end connected to the free end of a respective arm, each stay extending forwardly and inwardly such that a second can end of the stay can connect to a point on the vehicle chassis substantially in line with the suspension unit carrying the arm to which the stay is connected.

2. A front suspension unit as claimed in claim 1 in which each stay has a swivel connecting joint at said second end.

3. A front suspension unit as claimed in claim 1 in which each arm is connected to the respective outer casing of the respective suspension unit by a pair of individually adjustable bolts for adjusting the loading of the assembly.

4. A front suspension unit as in claim 1 and further comprising a plate for securing said suspension units to the chassis.

5. A motor powered off-road four wheeled vehicle comprising:

a vehicle chassis;

a pair of front suspension units each including at least one resilient block between an inner member and an outer casing with said outer casings mounted together;

each inner member carrying a laterally extending arm having a free end secured to a front wheel mounting assembly;

a steering assembly having a mounting column with a steering wheel on one end of a column supported from the vehicle chassis; and

a steering axle having a chain and sprocket mounted thereon with free ends of the chain attached to a rotatable plate to which is attached the ends of link arms attached to the wheel mounting assemblies.

6. An off-road vehicle as claimed in claim 5 in which each suspension unit is carried on a plate secured to the vehicle chassis.

7. An off-road vehicle as claimed in claim 5 in which the column is pivotally supported from the chassis and has an adjustable stay extending between the column and the chassis.

8. An off-road vehicle as claimed in claim 5 in which the ends of link arms remote from said plate are connected to rearwardly extending members rigidly connected to the wheel mounting assemblies.

9. An off-road vehicle as claimed in claim 8 in which the ends of the link arms attached to the plate are located close to the longitudinal center line of the vehicle and are at substantially the same height as the center line of the suspension units for the steered wheels.

* * * * *

United States Patent

[11] 3,586,236

[72] Inventor George Schaffler
Augsburg, Germany

[21] Appl. No. 829,535
[22] Filed June 2, 1969
[45] Patented June 22, 1971
[73] Assignee Keller & Knappich GmbH
Augsburg, Germany
[32] Priority Nov. 2, 1968
[33] Germany
[31] P 18 06 595.7

[54] WATER CANNON VEHICLE

11 Claims, 4 Drawing Figs.

[52] U.S. Cl. 239/172, 89/36, 169/2
[51] Int. Cl. B05b 17/00
[50] Field of Search 239/172; 169/1, 2, 24, 25; 296/1, 23, 24, 28, 84; 89/36

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Primary Examiner—Lloyd L. King
Assistant Examiner—John J. Love
Attorney—Allison C. Collard

ABSTRACT: A motor-driven water cannon vehicle having a cabin with a roof which includes swivel mountings for supporting a plurality of water nozzles. The cabin includes a windshield with a protective screen or grating mounted over it. Water nozzles are also provided on the sides of the vehicle to protect blind spots. The windshield also includes wipers and solvent wash sprays to clear away paint or chemicals used against the vehicle.

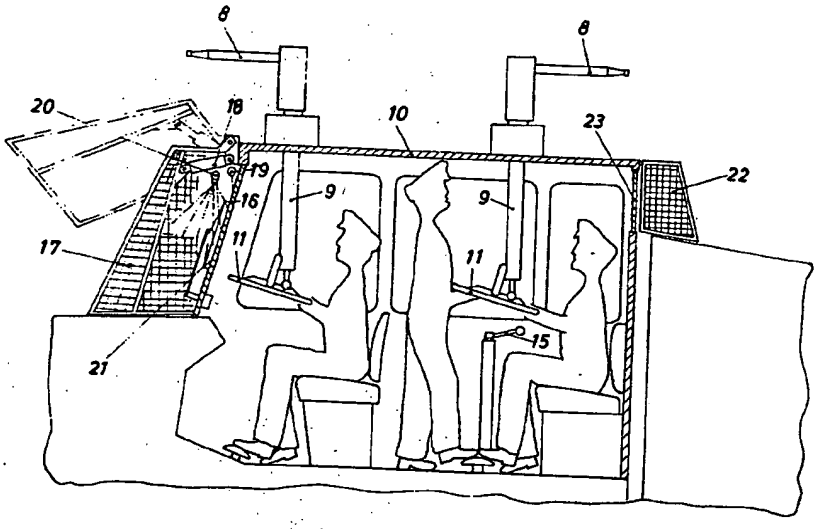


Fig.1

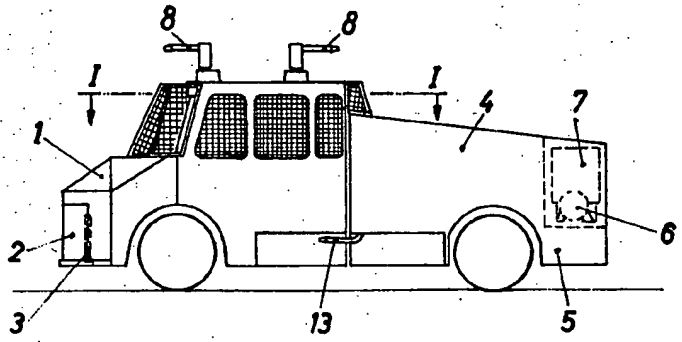
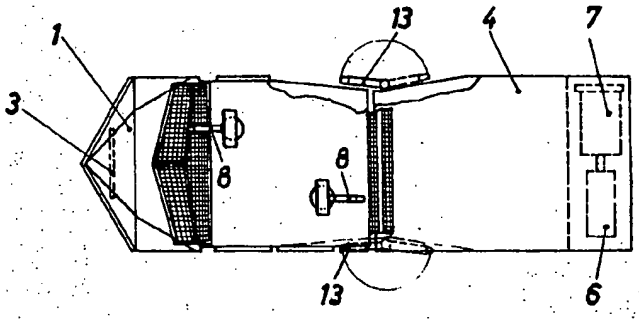


Fig.2



INVENTOR.
GEORG SCHÄFFLER
BY
ATTORNEY

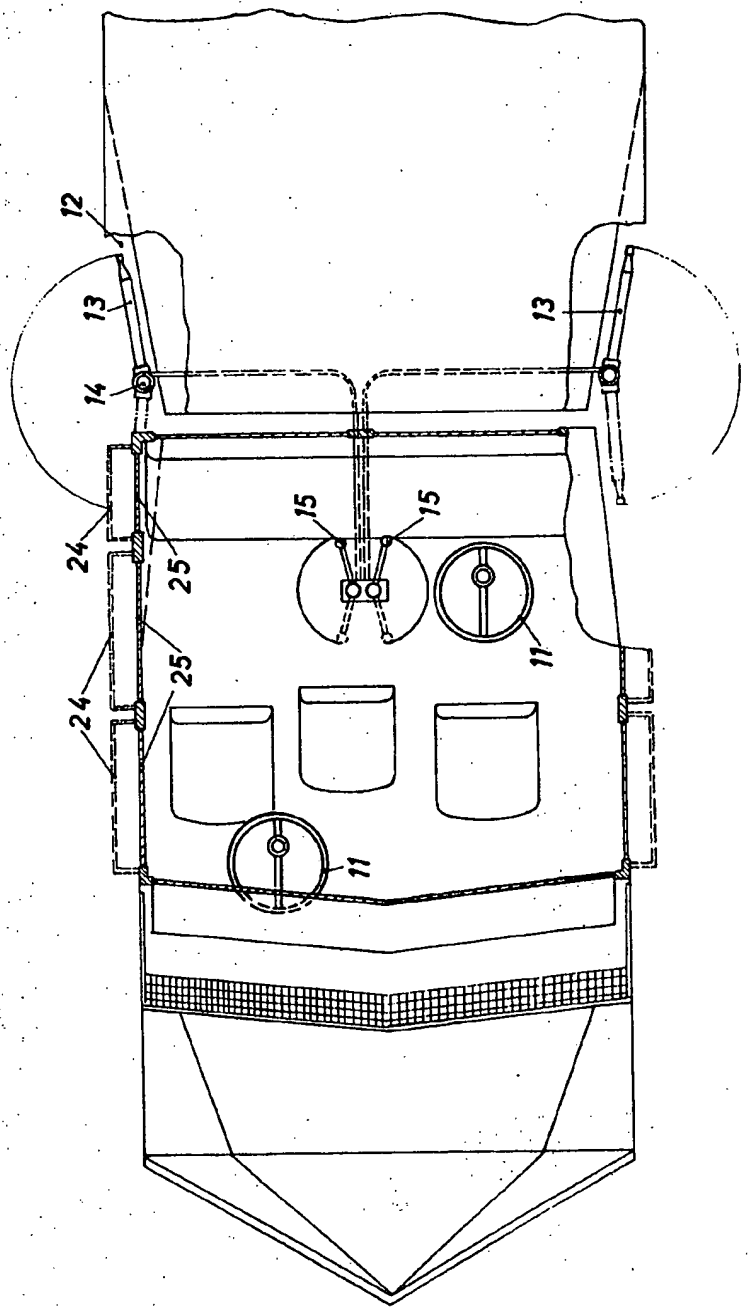


Fig. 3

INVENTOR.
GEORG SCHÄPELER
BY
ATTORNEY

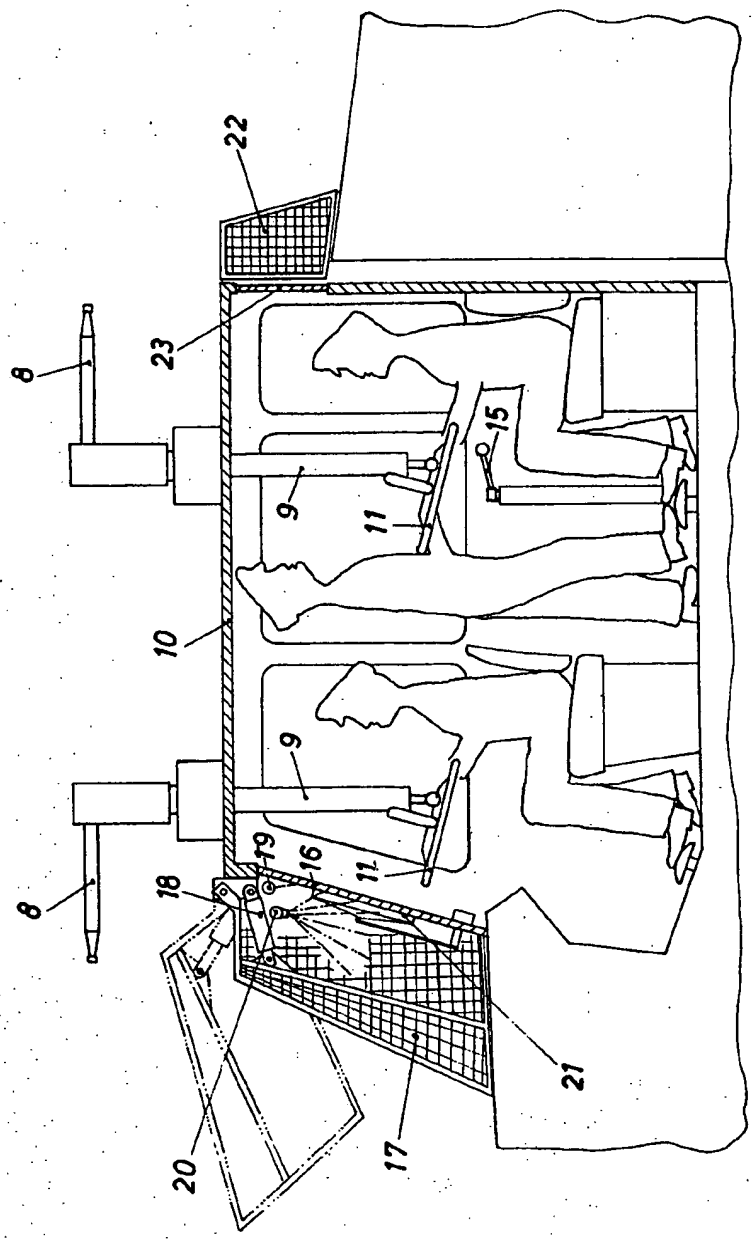


Fig. 4

INVENTOR.
GEORG SCHÄFFLER
BY
ATTORNEY

WATER CANNON VEHICLE

This invention relates to a motor-driven water cannon vehicle with pivotable water jets arranged on the sides and roof for use in operations against rioters and street mobs.

More specifically, this invention relates to a motor-driven water cannon vehicle which can be used against rioters and street mobs, and which can defensively sustain itself against attack from chemicals and flying objects.

The present invention provides a vehicle which can maintain itself in a constant state of readiness, by preventing obstruction of its vision by bombardment with containers of oil paints, or burning liquids. The vehicle is also resistant to close range attacks by particularly rough rioters. The only weapon used by the vehicle consists of powerful jets of water, which do not cause serious bodily injuries. These jets necessitate screening measures against weapons, the mostly likely ones being listed herein.

In accordance with the invention, the water cannon vehicle includes a protective grating of meshlike structure located at a considerable distance in front of its windshield. This grating causes paint containers, hurled against the vehicle, to be smashed as some distance in front of the windshield. The paint splashes which reach the windshield can be easily washed off by the use of cleaning fluids. The invention thus also provides a windshield washing installation which disperses a solvent for cleaning the windshield even when it is contaminated by oil paints or the like. The invention further provides a high pressure rinsing device, using water, to clean the windshield and to extinguish burning liquids. The protective grating over the windshield is preferably adapted to be hinged open and closed from within the driving cab, so as to allow an unobstructed view when the vehicle is driven to the site of operation.

In a further aspect of the invention, protective screens or gratings of meshlike structure are also arranged with clearance from the side windows. This allows the windows to be cleaned, at least partially, on their outside surfaces during operation without climbing out or removing the gratings.

Despite the fact that the jets can pivot in all directions on the roof, there are still blind spots around the sides of the vehicle which cannot be covered adequately. These blind spots, especially at the longitudinal sides, are open to close range attacks. In order to protect against these types of attacks, power water jets are arranged on the longitudinal sides or corners of the vehicle. These water jets are pivotal through 180°, or 270° at the corners in a horizontal plane. In their inoperative positions, they can be located in recesses on the sides of the vehicle to prevent them being boarded by rioters.

Some of the water jet nozzles may be provided with control columns projecting partly into the driving cab. These type of jets leave leg room, and allow freedom of movement for their operation, which has to be performed while standing, such as for the rear roof water cannon. The rear window also has a protective grating of meshlike structure arranged in front thereof, with a considerable spacing between the window and the grating.

It is therefore an object according to the present invention to provide a motor-driven water cannon vehicle which includes a plurality of pivotably mounted water jets capable of being directed against rioters.

It is another object of the present invention to provide a motor-driven water cannon vehicle which is capable of withstanding attack rioters.

It is still another object of the present invention to provide a motor-driven water cannon vehicle which is simple in design, easy to manufacture, and reliable in operation.

Other objects and features of the present invention will become apparent from the following detailed description considered connection with the accompanying drawing, which discloses one embodiment of the present invention. It is to be understood, however, that the drawing is designed for the purpose of illustration only, and not as a definition of the limits of the invention.

In the drawing, wherein similar reference characters denote similar elements throughout the several views:

FIG. 1 is a longitudinal side view of the vehicle

FIG. 2 is a plan view;

FIG. 3 is an enlarged, detail plan view taken along the section I–I of FIG. 1; and,

FIG. 4 is a fragmentary sectional longitudinal side view of the cab.

Referring to FIGS. 1—4, the vehicle motor which is mounted in front, is protected by an armored hood 1 which is wedge-shaped to clear obstructions. A front portion 2, of armored hood 1 is retained by quick-release fasteners which can be opened only with a key so as to provide access to a standard snowplow attachment plate 3 located behind it, thus allowing the vehicle to be used for clearing snow. The wedge-shaped armored hood 1 enables obstructions erected by rioters to be easily removed At the rear, behind the water reservoir 4, there is an armored space 5 for a water pump 6 and motor 7. Projecting from the roof of the cab, at the front and rear, are water nozzles 8 which are adapted to be vertically pivoted about a horizontal plane, and rotatable about a perpendicular axis, for which purpose their control columns 9 project from above, partly into cab 10. Control wheels 11 connected to columns 9 are ready at hand for manipulation of jets 8 when either seated or standing. There are also water jet nozzles 13 which are adapted to be pivoted 180° in operation about perpendicular axes 14 in horizontal plane, allowing the blind spots of the roof jets 8 to be swept at a lower elevation. Jet nozzles 13 are operated by means of hand levers 15, and can be located, when not in use, in recesses 12 within the profile of the vehicle.

In front of forward windshield 16, and displaced a small distance therefrom, is mounted a protective screen or grating 17 of meshlike construction. Grating 17 can be raised vertically by means of fluid pressure applied to hydraulic cylinders 18, as shown in dotted line in FIG. 4. Nozzles 19 disposed above the windshield, spray solvents for oil removal and the like. High pressured water nozzles 20 are also provided for washing windshield 16, with assistance from windshield wipers 21. The rear window 23 is also provided with a protective grating 22. The side windows 25 are covered over, a short distance therefrom, with protective gratings 24.

While only a single embodiment of the present invention has been shown and described, it will be understood that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

What I claim is:

1. A motor-driven water cannon vehicle comprising;
a cabin,
a roof disposed over said cabin,
a plurality of pivotable mountings disposed on said roof,
at least one water nozzle connected to each of said mountings,
a windshield mounted in said cabin,
a protective grating of meshlike construction mounted spaced-apart from and in front of said windshield on said cabin,
windshield washing means,
a solvent for dispersal from said washing means for washing said windshield when contaminated with oil base paint, and
high pressure water rinsing means for washing said windshield and for extinguishing burning liquids.

2. A motor-driven water cannon vehicle comprising;
a cabin,
a roof disposed over said cabin,
a plurality of pivotable mountings disposed on said roof,
at least one water nozzle connected to each of said mountings,
a windshield mounted in said cabin,
a protective grating of meshlike construction mounted spaced apart from and in front of said windshield on said cabin, and

water nozzle pivotable mountings disposed on the longitudinal sides of the vehicle for sweeping the blind spots of said roof nozzles, said pivotable mountings disposed on the longitudinal side being retractable into recesses defined by the vehicle.

3. The water cannon vehicle as recited in claim 2 additionally comprising further gratings spaced from the rear said columns side windows of said cabin, said gratings being of meshlike structure.

4. The water cannon vehicle as recited in claim 2 comprising control columns for said roof nozzles, said columns projecting through said roof partially into said cabin.

5. The water cannon vehicle as recited in claim 2 comprising wedge-shaped armored hood on the front of the vehicle for clearing obstacles.

6. The water cannon vehicle as recited in claim 5, wherein said hood defines an opening, a snowplow attachment plate mounted behind said opening, and a lockable front section for securing said opening to said vehicle.

7. The water cannon vehicle as recited in claim 4, comprising means operable from said cabin for moving said protective grating vertically upward and downward.

8. The water cannon vehicle as recited in claim 1 additionally comprising further gratings spaced from rear and side windows of said cabin, said gratings being of meshlike structure.

9. The water cannon vehicle as recited in claim 1, comprising control columns for said roof nozzles, said columns projecting through said roof partially into said cabin.

10. The water cannon vehicle as recited in claim l, comprising wedge-shaped armored hood on the front of the vehicle for clearing obstacles.

11. The water cannon vehicle as recited in claim 10, wherein said hood defines an opening, a snowplow attachment plate mounted behind said opening, and a lockable front section for securing said opening to said vehicle.